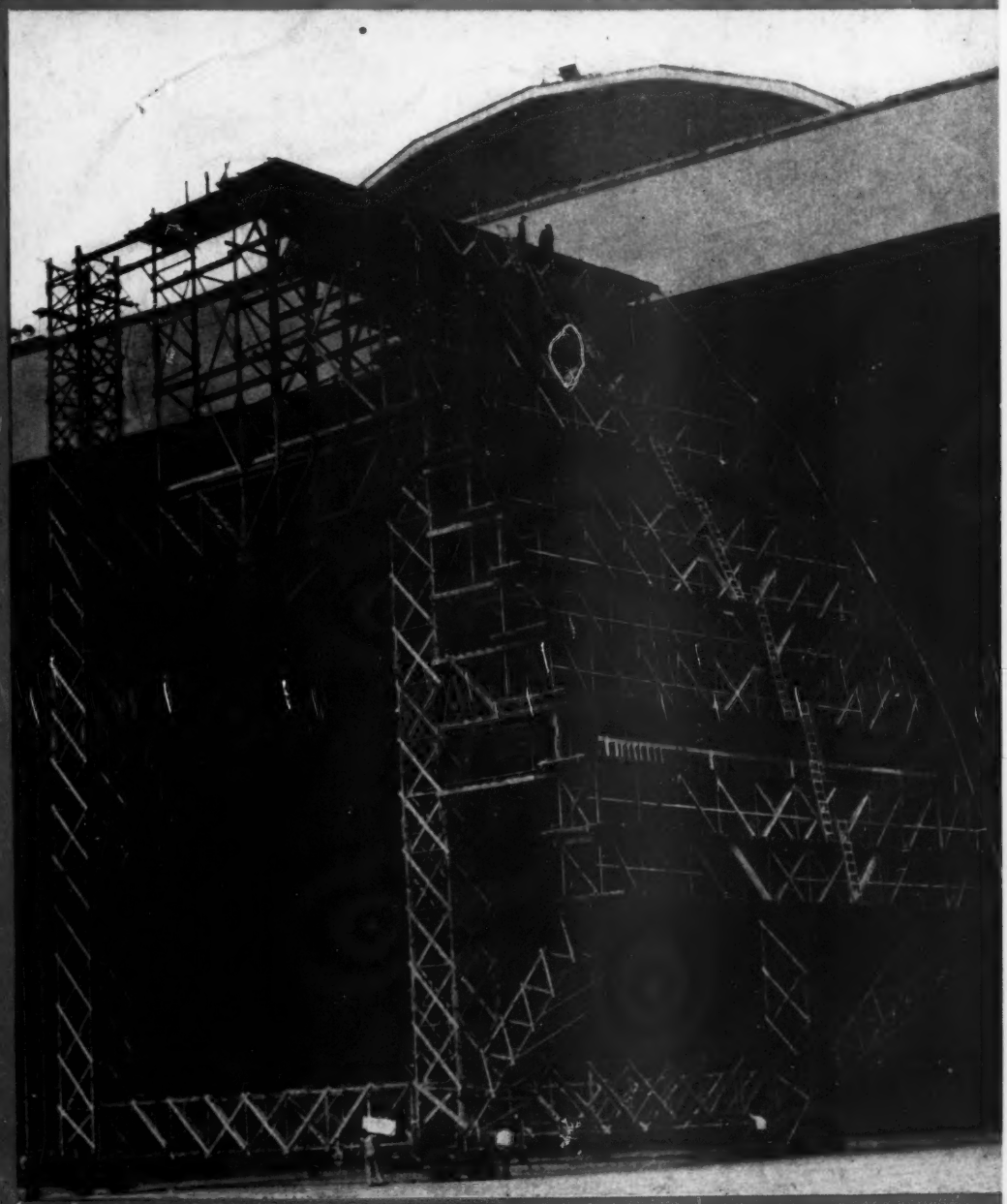
ENGINEERING NEWS-RECORD

FEBRUARY 6, 1947

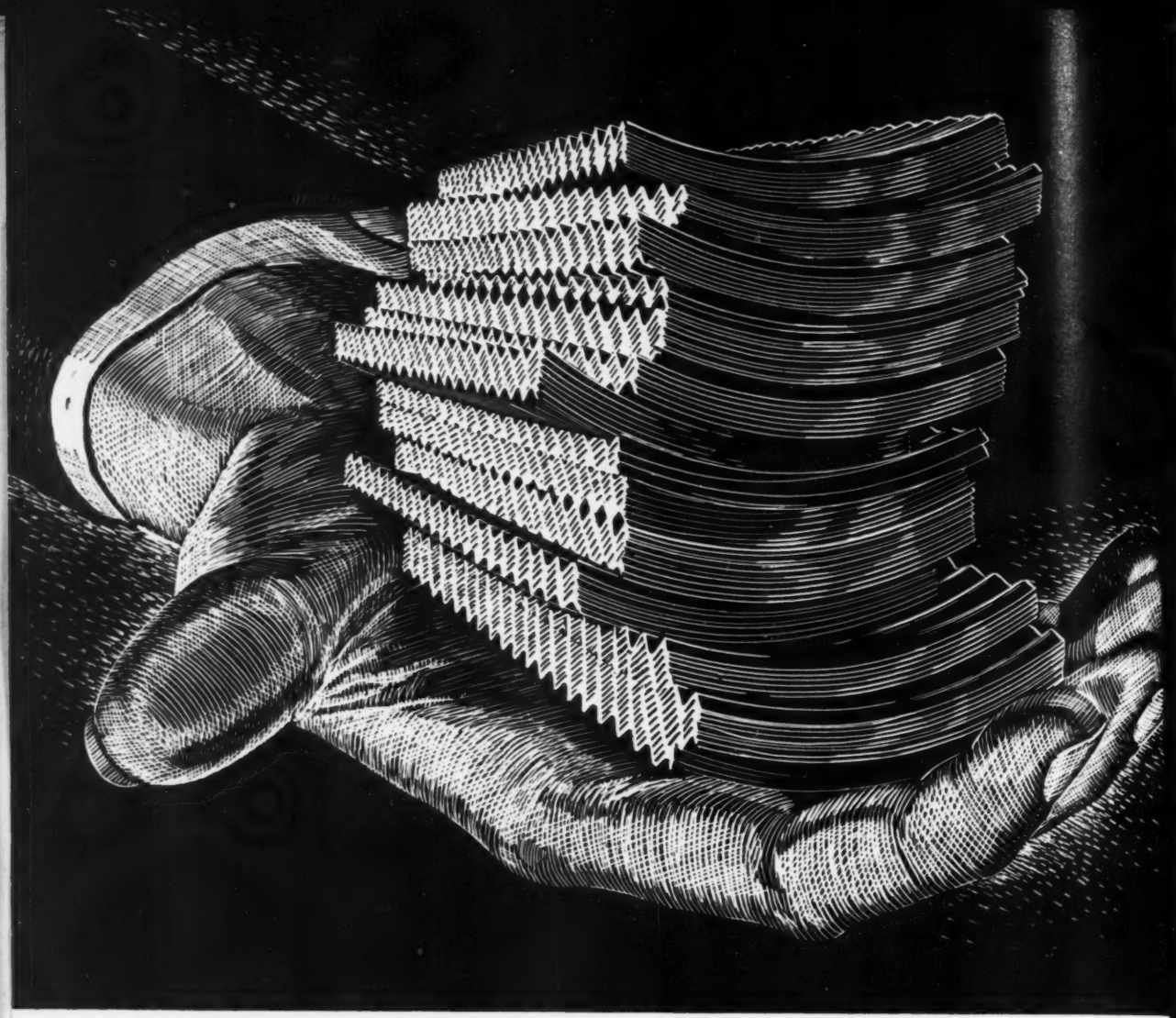


...COST LININGS
...RIGATION CANALS

...T CITY PROJECTS
... SUPPLY FOR 1970

...LAB FLOORS REST
...T-IRON COLUMNS

...caffold 145 ft. high
...platform for workers
... blimp docks for the
... Moffett Field, Calif.



"Packaged" bridges "over the counter"

You can't buy bridges from a vending machine but here's the next thing to it.

With Armco-developed MULTI PLATE Arches, Pipe and Pipe-Arches, you get prefabricated structures delivered to the job site ready for quick, fool-proof installation by unskilled labor. Individual plates are nestable —easy to transport and handle. Time and labor savings reach a new high. MULTI PLATE was the first prefabricated complete drainage structure designed for field assembly.

Other Armco "firsts" have gained equal reputation in drainage and construction fields—Hel-Cor Perforated Pipe, Retaining Walls, Pipe-Arches, STEELOX Buildings, improved coatings and pavements to whip corrosion and erosion—and many more. In cooperation with engineers and contractors, Armco men have developed products that speed installation, assure greater safety and lower costs.

These are some of the reasons why it will be worth your while to bring your problems to Armco. Here you will find a complete range of engineered products and convenient authoritative data in every field—highway, railway, airport, municipal or industrial. If your problem is unusual, you'll want to talk it over with one of our specialized engineers.

Structural Plate Pipe and Arches ★ Corrugated Metal Pipe ★ Welded Steel Pipe ★ FLEX-BEAM Guardrail ★ Water Control Gates ★ Retaining Walls ★ STEELOX Buildings ★ Sheeting ★ Tunnel Liner ★ Subdrainage Pipe ★ End Sections ★ Pipe Piling and Pile Shells ★

Armco Drainage & Metal Products, Inc.

MIDDLETOWN, OHIO • • • OFFICES IN PRINCIPAL CITIES

ARMCO

ENGINEERING NEWS-RECORD

Devoted to Buildings, Sewerage, Waterworks, Bridges, Roads, Dams, Foundations, Earthwork, Flood Control, Public Works, Airports, Irrigation, Tunnels, Railroads

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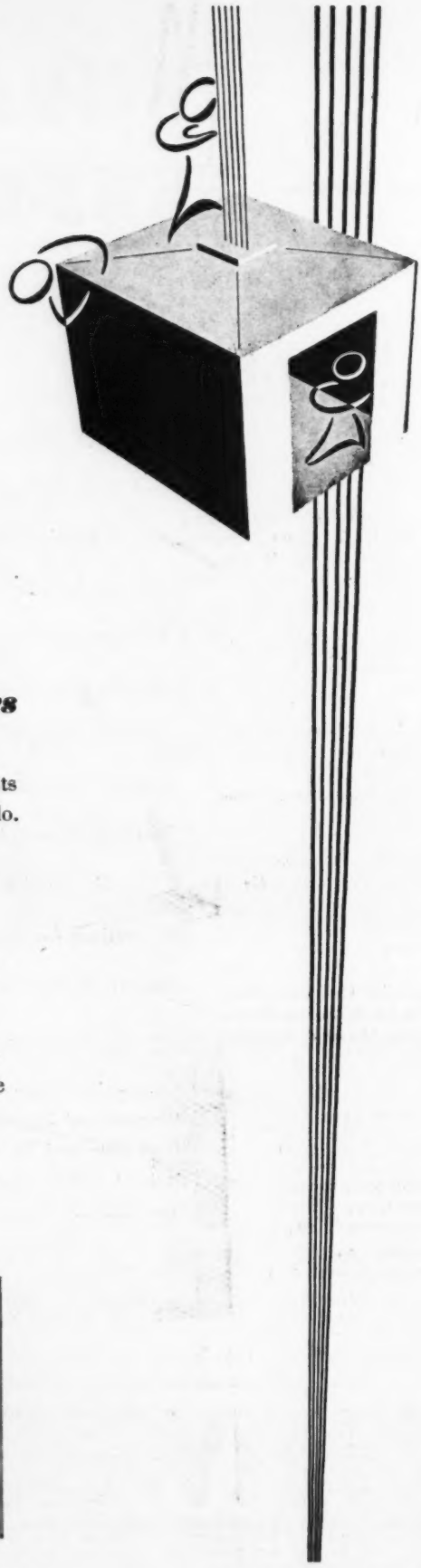


clock stopper

Otis *maintenance* *for* Otis *elevators*

Ordinarily, you would expect elevator maintenance costs to increase as equipment grows older. Ordinarily they do.

But not so with Otis Maintenance. For this is not an ordinary service. It is complete maintenance by a manufacturer who has demonstrated that properly maintained elevator equipment is unaffected by age.

Otis Maintenance rates are adjusted every *five* years in accordance with prevailing costs of labor and material. They are never increased due to age of the equipment. If your elevator is new when placed in our care, the rate continues as on a "new" elevator for the duration of the contract.

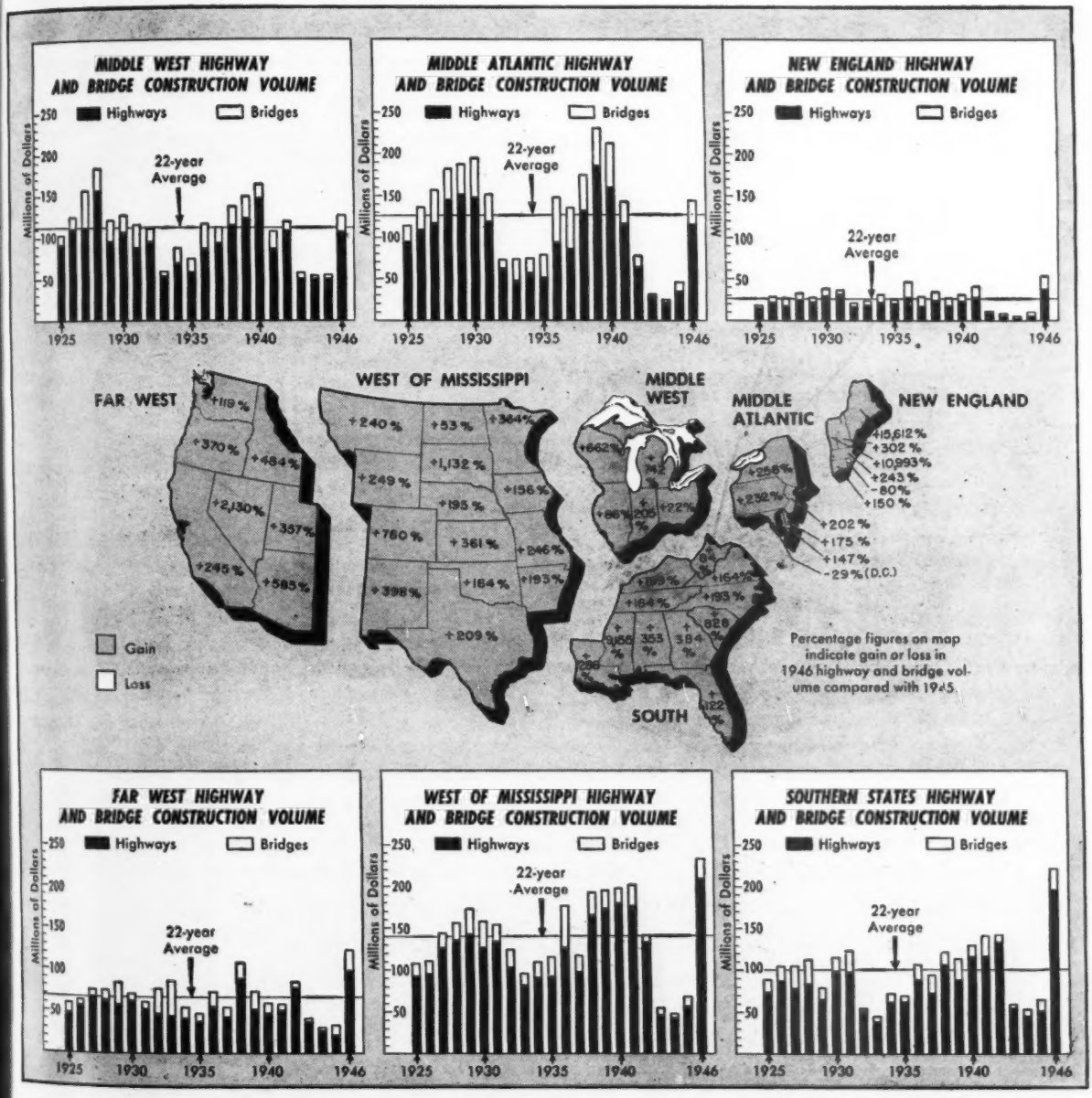
Every Otis Maintenance contract increases in value to the building owner as time goes on. Therefore, the sooner you start . . . the more you save.

Otis ELEVATOR COMPANY
OFFICES IN ALL PRINCIPAL CITIES

Construction Trends

Distribution of Highway and Bridge Construction

All six sections gain over 1945 volume with forty-seven states recording gains



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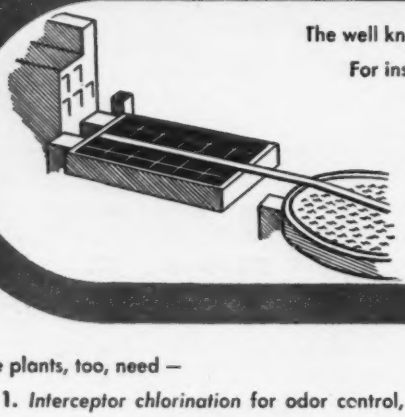
CONSIDER THE RULE OF 3 IN YOUR PLANNING



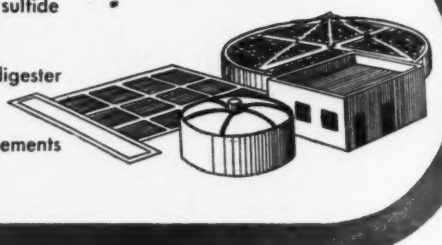
The well known rule of three applies in chlorination as well as it does in mathematics.

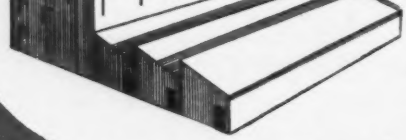
For instance, water plants need —

1. *Prechlorination* for improved coagulation, color removal, algal control, etc.
2. *Plant chlorination* for increased filter runs, sterilization, manganese removal and increased plant efficiency.
3. *Post chlorination* for taste and odor control and elimination of gas-formers throughout the system.

Sewage plants, too, need —

1. *Interceptor chlorination* for odor control, reduction of hydrogen sulfide damage to concrete structures and prevention of septicity.
2. *Plant chlorination* for odor control, prevention of sludge bulking, digester super-natant treatment, prevention of filter ponding, etc.
3. *Effluent chlorination* for sterilization to meet stream pollution requirements and prevent damage to recreation areas.





And Industrial plants need —

1. *Process Water chlorination* for quality control and elimination of spoilage losses.
2. *Cooling Water chlorination* for increased heat exchanger efficiency and reduced labor costs.
3. *Waste Water chlorination* to facilitate disposal of objectionable mill-waste products.

Thus, in your planning for any plant, consider the three time use of chlorination for a more flexible, better equipped plant with the low cost "room for expansion" that only chlorination can give.

A wealth of new information on the uses of chlorination is yours for the asking and any W & T Chlorination Specialist will be glad to assist you on your chlorination problems. Call on them freely.

WALLACE & TIERNAN
COMPANY, INC.

MANUFACTURERS OF CHLORINE AND AMMONIA CONTROL APPARATUS
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S-2

New Construction Volume in January

Civil engineering construction volume in continental United States totals $430,970,000 for January, an average of $86,194,000 for each of the five weeks of the month. This average is 2 percent below the average for December, and is 24 percent above the average of January, 1946, according to *Engineering News-Record*.

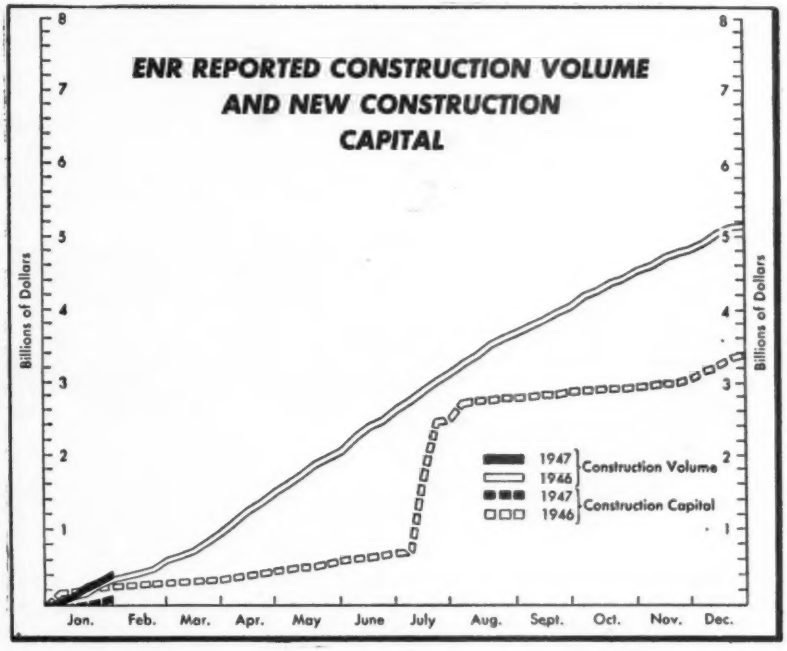
Private construction for January on a weekly average basis is 9 percent below last month, but 18 percent greater than January, 1946. Public construction is 13 percent above last month, and 36 percent above last January. State and municipal construction, while 10 percent below last month, is 53 percent above the average for January, 1946. Federal construction, up 238 percent from last month, is 8 percent above January, 1946.

Weekly averages in the various classes of construction for January, 1947 compared with December, 1946, show gains in waterworks, of 54 percent; public bridges, 26 percent; commercial buildings, 71 percent; public buildings, 59 percent; and public unclassified, 134 percent; losses in highways, 30 percent; sewerage, 18 percent; earthwork and drainage, 17 percent; industrial buildings, 57 percent; and private unclassified, 22 percent.

Geographically, only two sections showed gains in January, 1947 over December, 1946—Middle Atlantic, 34 percent, and Far West, 137 percent. New England dropped 13 percent below December; South, 48 percent; Middle West, 23 percent; and West of the Mississippi, 17 percent.

Four sections made gains in January, 1947 over January, 1946—Middle Atlantic, 115 percent; South, 72 percent; West of the Mississippi, 21 percent; Middle West, 19 percent. New England dropped 63 percent below last year, and Far West, 16 percent.

New capital for construction purposes for the five weeks of January, 1947 totals $108,413,000, or a weekly average of $21,682,000, 72 percent below the December, 1946 average, and 59 percent below the average for January, 1946.


ENR REPORTED CONSTRUCTION VOLUME AND NEW CONSTRUCTION CAPITAL
Billions of Dollars
Billions of Dollars
1947 Construction Volume
1946 Construction Volume
1947 Construction Capital
1946 Construction Capital
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

ENGINEERING CONSTRUCTION CONTRACTS REPORTED TO ENGINEERING NEWS-RECORD—JANUARY, 1947

Engineering News-Record *reports continental U. S. Construction projects of the following minimum costs — Waterworks, excavation, drainage and irrigation,* $22,500 *other public works,* $40,000; *industrial buildings,* $55,000; *other buildings,* $205,000

Five Weeks — Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States January 1947	United States January 1946	Canada
Public Works									
Waterworks	136	2,268	724	1,411	1,054	9,265	14,858	5,298	713
Sewerage	.....	1,124	284	2,458	1,613	2,455	7,934	2,453	916
Bridges, public	160	930	2,462	913	3,080	2,028	9,573	9,134	443
Earthwork and waterways	191	104	3,526	182	2,188	2,503	8,694	27,839	3,066
Streets and roads	854	5,387	12,596	4,368	11,081	4,279	38,565	35,956	285
Buildings, public	890	25,690	7,268	8,280	4,197	5,117	51,442	22,517	9,073
Unclassified, public	.....	8,151	5,134	345	5,071	1,288	19,989	7,617	5,564
Total public	2,231	43,654	31,994	17,957	28,284	26,935	151,055	110,814	20,060
Federal government (included in above classifications)	67	23,335	9,156	836	6,651	3,143	43,188	40,173	.....
Private									
Bridges, private	.....	.....	.....	.....	.....	.....	.....	1,025	.....
Industrial buildings	3,472	19,853	7,186	9,827	29,631	7,771	77,680	106,794	5,225
Commercial buildings	7,970	70,903	31,752	15,529	11,692	49,921	187,767	118,202	6,510
Unclassified, private	80	2,640	2,046	441	5,139	4,132	14,468	11,442	6,130
Total private	11,522	93,486	40,974	25,797	46,372	61,764	279,915	237,463	17,865
Total Engineering Construction:									
January, 1947 — 5 weeks	13,753	137,140	72,968	43,754	74,656	88,699	430,970	.....	37,925
December, 1946 — 4 weeks	12,667	81,824	111,365	45,280	71,690	29,999	352,855	.....	21,791
January, 1946 — 5 weeks	37,090	63,908	42,463	36,743	61,920	106,153	.....	348,277	24,263

TWELVE KEYS to Steel-Service

Ryerson Steel-Service plants now stand in twelve great cities—key points covering the nation's principal steel markets. Cooperating fully, the twelve-plant Ryerson system means broader facilities, shorter shipping distances, and the assurance of prompt delivery of all products in stock.

The plant near you employs the best of modern handling and cutting methods, from order desk to shipping department. It is planned and operated to meet your steel needs accurately and deliver them in a hurry.

Under present conditions we are often unable to fill all your requirements—much as we would like to. Because of great demand and frequent work stoppages many products may not be in stock when you call. But if your order includes an item not readily available, our steel-service men are well qualified to assist you in the search for a practical alternate. And Ryerson continues as your best source for a wide variety of steels.

Whether you need a single piece of steel or several tons, your order receives thorough, personal attention. So, phone or write or wire your nearest Ryerson plant whenever you need steel.

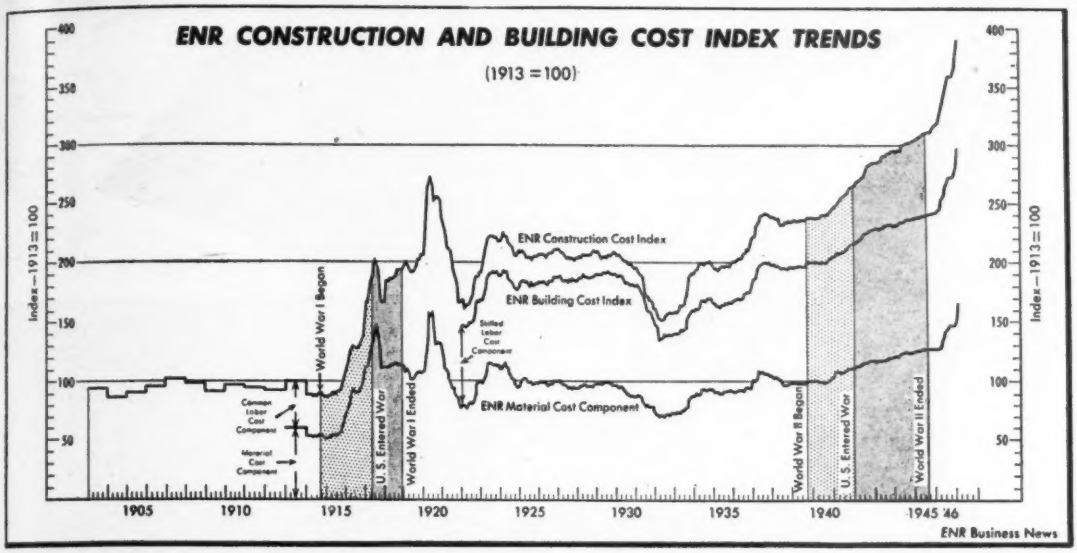
Joseph T. Ryerson & Son, Inc, Steel Service Plants: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles.

PRINCIPAL PRODUCTS

- Bars—
  - hot and cold rolled
  - alloy steel
  - reinforcing
- Structurals
- Plates—
  - Inland 4-Way Floor Plate
- Sheets
- Strip Steel
- Mechanical Tubing
- Boiler Tubes and Fittings
- Allegheny Stainless—
  - Sheets, plates, shapes, bars, tubing, etc.
- Tool Steel
- Wire, Chain
- Bolts, Rivets
- Babbitt
- Solder
- Wire Fabric
- Metal Working
  - Tools and Machinery, etc.

RYERSON STEEL

FEBRUARY CONSTRUCTION BUSINESS REPORT



ENR CONSTRUCTION VOLUME AND NEW PRODUCTIVE CAPITAL

Thousands of Dollars (,000 omitted)	January 1946 (5 wk.)	January 1947 (5 wk.)	% Change
Total U. S. Construction	$348,277	$430,970	+24
Private Construction	237,463	279,915	+18
Public Construction	110,814	151,055	+36
Federal	40,173	43,188	+8
ENR Construction Volume Index, 1913 = 100	189	195	+3
Total New Productive Capital	262,117	108,413	−59
Private Investment	103,797	108,413	+4
Federal (non-federal work)	.....	.....	....
Federal (federal work)	158,320	.....	....

ENR INDEX NUMBERS

Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
Feb., 1947	390.76	187.84	297.38	160.75	...	...
Jan., 1947	381.68	183.47	288.78	156.11	195	86
Dec., 1946	368.10	176.95	278.49	150.54	207	91
Nov., 1946	362.47	174.24	273.71	147.96	164	72
Oct., 1946	360.94	173.50	272.74	147.43	233	103
Sept., 1946	360.19	173.14	272.04	147.06	233	98
Aug., 1946	361.37	173.71	271.98	147 02	258	113
July, 1946	353.89	170.11	266.13	143.86	327	144
June, 1946	347.91	167.24	264.16	142.80	344	151
May, 1946	339.09	163.29	257 25	139.06	284	125
April, 1946	334.59	160.83	254.37	137.50	340	149
Mar., 1946	323.83	155 66	245.41	132.66	256	112
Feb., 1946	319.52	153.59	243.94	131.86	167	73
Jan., 1946	316.32	152.05	242.23	130.94	189	83
1946 (Av.)	345.74	166.19	261.87	141.55	250	110
1945 (Av.)	307.74	147.93	239.14	129.27	123	54
1944 (Av.)	298.63	143.39	234.73	126.89	95	42
1943 (Av.)	289.95	139.38	228.75	123.66	176	77

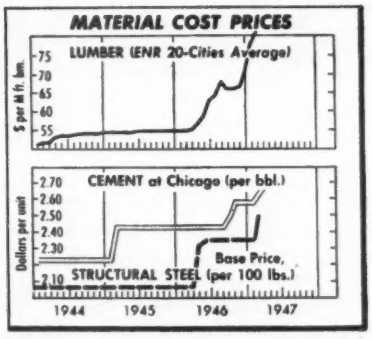
CONSTRUCTION COST .... WAGE RATES .... MATERIAL PRICES

	February 1946	February 1947	% Change	Change January to February 1946 Jan.	1946 Feb.	1946 %	1947 Jan.	1947 Feb.	1947 %
ENR Constr. Cost Index†	319.52	390.76	+22.30	316.32	319.52	+1.0	381.68	390.76	+2.38
ENR Building Cost Index†	243.94	297.38	+21.91	242.23	243.94	+0.7	288.78	297.38	+2.98

† *Does not reflect increased costs due to overtime, lower labor efficiency, delivery delays, etc.*

ENR 20-CITIES' AVERAGE

Common Labor	$0.968	1.123	+16.01	$0.953	$0.968	+1.6	$1.109	1.123	+1.26
Skilled Labor (Av. 3 Trades)	1.726	1.919	+11.18	1.701	1.726	+1.5	1.885	1.919	+1.80
Bricklayers	1.823	2.047	+12.29	1.787	1.823	+2.0	1.996	2.047	+2.56
Structural Ironworkers	1.764	1.924	+9.07	1.748	1.764	+1.0	1.898	1.924	+1.37
Carpenters	1.592	1.779	+11.75	1.567	1.592	+1.6	1.753	1.779	+1.48
Cement, per barrel	2.73	3.366	+23.30	2.74	2.73	−0.3	3.302	3.366	+1.94
Reinforcing Steel, cwt.	2.79	3.475	+24.55	2.79	2.79	0.0	3.364	3.475	+3.30
Structural Steel, base	2.10	2.50	+19.05	2.10	2.10	0.0	2.350	2.50	+6.38
Sand, per ton	1.25	1.672	+33.76	1.25	1.25	0.0	1.559	1.672	+7.25
Lumber, 2x4 Fir, per M ft.	54.99	80.406	+46.22	54.99	54.99	0.0	80.516	80.406	−0.14
Lumber, 2x4 Pine, per M ft.	54.55	81.238	+48.92	54.55	54.55	0.0	76.471	81.238	+6.23
Common brick, per M	20.00	22.421	+12.11	19.91	20.00	+0.4	23.150	22.421	−3.15
Ready-mixed concrete, c.y.	7.73	8.649	+11.89	7.64	7.73	+1.2	8.523	8.649	+1.48
Struct. clay tile, 3x12x12	88.49	107.293	+21.25	89.22	88.49	−0.8	102.186	107.293	+5.00

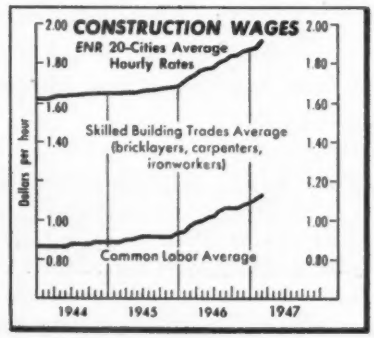


MATERIAL SHIPMENTS .... BUILDING PERMITS

	January 1946	January 1947	% Change	December 1946	% Change December to January
Steel (% operating Capacity) A.I.S.I.	42.2	91.4	+117	74.9	+22

	November 1945	November 1946	% Change	Eleven Months 1945	Eleven Months 1946	% Change
Cement, thous. bbl. U.S.B. of Mines	10,342	14,803	+43	100,298	157,842	+57

	December 1945	December 1946	% Change	Twelve Months 1945	Twelve Months 1946	% Change
Fabricated Structural Steel, tons, A.I.S.C.	68,767	142,071	+107	797,441	1,551,607	+95
Building Permits, 215 Cities, Dun & Bradstreet (,000 Omitted)	$204,008	$148,030	−27	$1,258,021	$2,556,378	+103

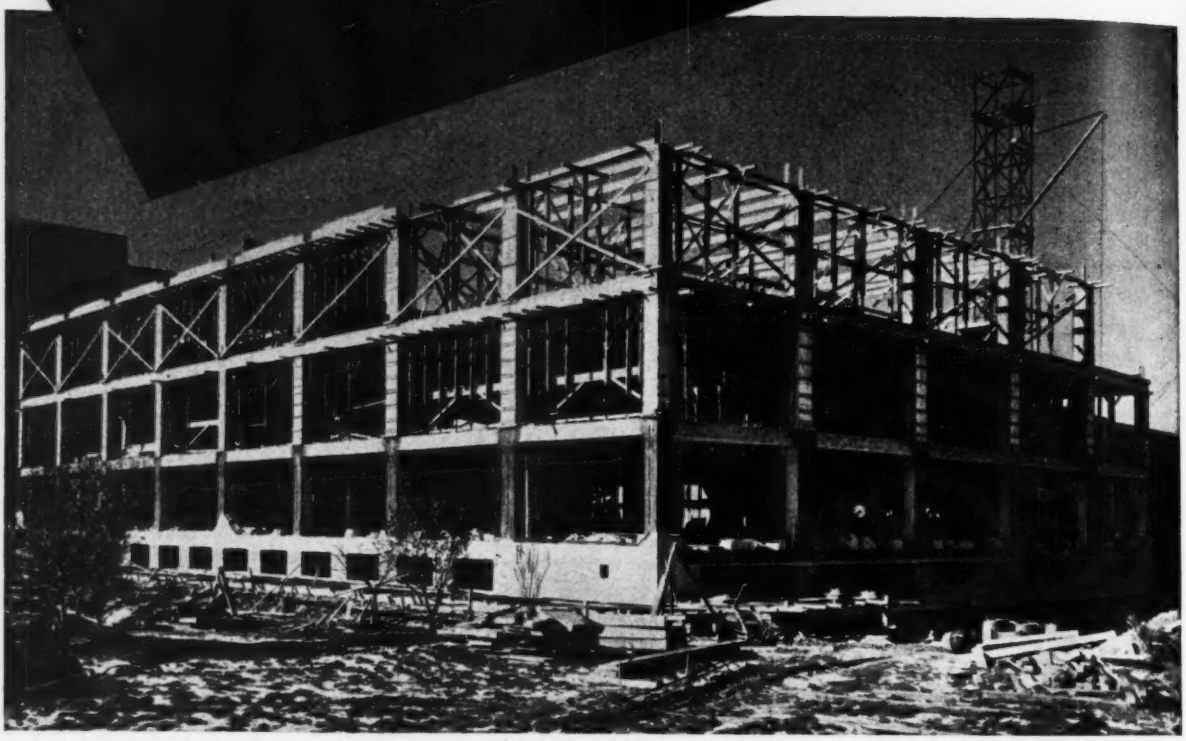


COST OF LIVING INDEX .... EMPLOYMENT

	December 1945	December 1946	% Change	November 1946	% Change November to December
Consumers' Price Index, B L S	129.9	153.3	+18.0	151.7	+1.1
Rent (Housing) Index, B L S	108.3	108.8	+0.5	108.0	.....

	January 1946	January 1947	% Change	December 1946	% Change December to January
Const. Employment (est.), thous., B L S	1,267	1,728	+36.4	1,875	−7.8
Private Const. Employ. (est.), thous., B L S	1,088	1,366	+25.6	1,481	−7.8

When the job is labeled "Rush" ...



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News of the Week

ENGINEERING NEWS-RECORD • FEBRUARY 6, 1947 • VOLUME 138 • NUMBER 6

AFL building trades unions, AGC sign arbitration accord

Agreement sets up machinery for voluntary arbitration of disputes between contractors and employees—Hailed as major step toward industrial peace

Machinery for handling on a national scale employer-union disputes affecting the construction industry through the establishment of arbitration boards whose decisions will be binding on disputants was announced Feb. 1.

Characterizing the agreement as "the best labor news for a good while," President Harry S. Truman said the voluntary arbitration agreement signed by the Associated General Contractors of America, Inc., and the Building and Construction Trades Department of the American Federation of Labor was a major move toward the objective of free collective bargaining.

The President was joined by labor and employer officials in emphasizing that the agreement was drawn up in conference by the two parties, without government interference or suggestion. Although the AGC's general membership was assembled in its 28th annual convention at Chicago during last week (see p. 55 this issue) no announcement was made, pending the President's statement to Washington newspaper and magazine representatives.

Not compulsory arbitration

The AFL Building Trades council claims to represent 2,000,000 construction workers in its 19 affiliated units—about 90 percent of workers in the field.

Four major points are included in the agreement:

1. Three permanent arbitration committees are set up, to handle disputes arising in the fields of heavy construction, highway and road construction and building; and provision is made for establishment of special committees to handle disputes in fields outside these three main divisions.

2. Membership in these committees will include one representative of contractors and one of labor unions engaged in the particular activity in which the dispute has arisen.

3. Disputes are to be submitted to these committees for arbitration only when they cannot be settled at a lower level, but when submitted, both parties agree voluntarily that they will accept the decision of committee as binding.

4. Disputes involving contractors who employ some non-union workers will not be handled.

The agreement contains no prohibition against strikes while a dispute is being considered by the committee, does not impose any penalty for failure to accept the decision of the committee by either party, and jurisdictional disputes between unions are not mentioned.

In addition to the contractors' and union representatives on the arbitration committees, other members will be a representative of national associations serving the specialized and subcontracting employers; and a member of the Building Trades Department representing union men employed by the specialized and subcontracting employers.

A joint letter sent to Mr. Truman by H. E. Foreman, managing director of AGC and Richard Gray, president of the AFL subsidiary, emphasized that local agreements such as those now existing in New York City and Chicago which are along the same lines as the national plan will not be disturbed by new plan.

"Having established this voluntary machinery to settle disputes in this important industry without stoppage of work by lockout or strike, our organizations intend to see that . . . these procedures are used wherever possible," the letter said. "This important industry is anxious to accept its responsibilities."

The arbitration agreement is another peace step by contractors and unions.

Building trades wages raised in Houston, Tex.

A wage increase controversy between the Associated General Contractors and the A. F. of L. Building Trades Council at Houston, Tex., was settled recently. On Jan. 2 about 40 cement finishers and 1,000 pipefitters walked off of their jobs demanding wage increases. Other crafts joined in wage increase demands, work was stopped on six big building projects, and a city wide construction tie-up was threatened.

The crafts asked wage increases of 25c to 37½c an hour. On Jan. 17, the controversy was settled when the labor committee of the Associated General Contractors agreed to wage increases of 25c an hour for skilled labor and 15c an hour for unskilled labor.

The new hourly wage scales agreed upon are: Bricklayers, $2.25; hoisting engineers and boilermakers, $2; structural steel and iron workers, $2.12½; cement finishers, carpenters, reinforcing steel, and pile-driver men, $1.87½; hod carriers, $1.25; teamsters, $1 for 1½ ton trucks and $1.10 for dump trucks; all other unskilled building workers, $95c.

Wake Island workers sue contractors for pay

A suit has been filed in Chicago by seven former Wake Island construction workers, asking more than $600,000 in back pay and damages. The suits were filed against the Hawaiian Dredging Co., Raymond Concrete Pile Co., Turner Construction Co., Morrison-Knudsen and J. H. Pomery & Co.

One of the seven, Oreal J. Johnson, Boise, charged that his employers paid him only one week's salary for the time he was held in captivity by the Japanese. That, he said, is one of the reasons he and the other civilians, captured by the Japanese while the workers were employed on naval contracts, filed the suits.

The actions were filed in behalf of the "Workers of Wake, Guam and Cavite," an organization of those who survived imprisonment by the Japanese. The organization was formed in Boise, Idaho, slightly over a year ago and has held both of its national conventions there.

Pending court action on the suits, officials of the companies involved made no public statements on the matter.

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Highways—The Arizona State Highway Department will ask bids this spring for construction of three major highway bridges for the projected State Highway 93 which will cut 111 miles from the distance between *Kingman* and *Phoenix*. . . . *North Carolina* will spend $800,000 for repairs and improvements to highway bridges. . . . Legality of an Ohio legislative proposal to create a turnpike commission to issue toll-secured bonds to finance construction superhighways may be challenged under the state constitution which prohibits tolls on public roads. . . . About 30 miles of U. S. Highway 1 in *Palm Beach, Broward* and *Dade* counties, Fla., will be converted to 4-lane roads this year under a $4,000,000 program. . . . Work will start soon on a $5,000,000 project to depress tracks of the Southern Pacific Railroad in the business district of *El Paso, Tex.* . . . Legislation establishing new highway taxes and revision of bus and truck license fees to bring in a total of $9,500,000 additional revenue is before the *Arkansas* legislature.

Sewers—Plans have been completed for sewer extensions at *Waycross, Ga.*, to cost $132,000. . . . With approval of a $25,000 grant for planning, *Indianapolis, Ind.*, has started work on an $800,000 storm sewer project. . . . Twelve Pennsylvania communities, including *Plains, Dupont, Brookville, Latrobe* and *Lemoyne*, have announced plans for sewerage projects totalling more than $5,000,000. . . . The *Hartford, Conn.*, Metropolitan District's bureau of public work has announced long-range plans for a $3,000,000 sewerage program including development work in *East Hartford, Hartford, Newington* and *Bloomfield*.

Water Supply—*Tyler, Tex.*, city commissioners have approved plans for construction of a $1,150,000 supplementary water reservoir, to cover 2,975 acres. . . . *New Haven, Ind.*, village trustees have asked bids for Feb. 17 for construction of a $120,000 water system, including a new pumping station, a 300,000-gal. water tank and installation of equipment for pumping.

Industrial Construction—McCarthy Chemical Co. will start work immediately on a $3,000,000 chemical plant at *Winnie, Texas*, 55 miles from Houston. . . . The Daniels Construction Co. of Greenville, S. C., will start work soon on a $37,000,000 plant for the Celanese Corp. at *Rock Hill, S. C.* . . . The Dow Chemical Co. announced a $15,000,000 plant expansion program. . . . Pickands, Mather and Co. plans construction of a $1,500,000 plant on the Mesabi iron range for concentrating iron ore from *Taconite*. . . . The Semet-Solvay Co. will start a $6,000,000 expansion of its plant at *Buffalo, N. Y.*, to increase its manufactured gas capacity. . . . A $10,000,000, 10-story office building, to be known as the Angelo Building, is planned for *Houston, Tex.*

Public Construction—Jackson, Miss., planned construction of a $300,000 high school. . . . Scott and White Hospital, at *Temple, Tex.*, has announced a $5,000,000 construction program, to include a 10-story clinic, nurses home, a power plant and other structures. . . . Villanova College, *Villanova, Pa.*, let a $1,200,000 contract to McCloskey & Co., Philadelphia, for construction of three new buildings. . . . Because of "inflated" labor and general construction costs, the $7,000,000 City-County Memorial Hospital at *Dallas, Tex.*, will not be started until 1948, board members announced. . . . At a cost of $18,000,000, the University of Illinois at *Urbana* will erect a new power plant and four buildings for the institution.

Housing—William Joern and Sons, Chicago, Ill., will build a $3,500,000 subdivision at *LaGrange Park, Ill.*, including 19 brick two and three-story structures. . . . Michael Lubin, of Philadelphia, Pa., plans a $1,000,000 residential development at *Clifton Heights* and *Cheltenham, Pa.* . . . Construction will start immediately on a $2,500,000 housing project at Pasadena, Tex. The Rasnick Manufacturing Co. of Houston, builder, said it plans to prefabricate parts of the homes, and offer completed units for sale to the public for $4,900 to $5,900.

Flood control commission urged for Pennsylvania

The directors of the Susquehanna Flood Control Association at a recent meeting in Williamsport, Pa., made preparations to incorporate as a non-profit organization. E. V. Allison, executive secretary, reported members believe that the program would benefit if Pennsylvania had some type of state authority similar to the New York State Flood Control Commission.

A new study of the entire Susquehanna flood problem has been ordered by the War Department and is being made by the Army Engineers. Last month Col. J. S. Seybold, Army district engineer, Baltimore, Md., met representatives from the northern counties of the state at Towanda to learn the needs for flood control along the Susquehanna River.

Executive Secretary Allison said the association recommended the construction of a series of impounding "dry dams" to be used exclusively when waters reach the flood stage. He said such dams would be less expensive and more practicable than multiple-purpose dams.

The Harrisburg Chamber of Commerce recently organized a flood control committee to investigate the problem of flood control in the south-central area of the state.

During the 1946 session of Congress, the Senate approved authorization totalling more than $26,000,000 for flood control and river and harbor improvements in Pennsylvania. No funds were provided.

Work is started on big Boston bridge

The first work on the $20,000,000 toll bridge over the Mystic River between the Charlestown section of Boston, Mass., and Chelsea, started Jan. 27. Engineers are already taking the river soundings and a number of contracts have been signed to push the construction work.

This structure, 135 ft. above the water level, is expected to wipe out one of Boston's worst traffic bottlenecks—the drawbridges over the river which sometimes cause tieups stalling traffic as far as downtown Boston.

J. E. Greiner Co., Baltimore, Md., has been retained to prepare the construction plans. Deleuw, Cather & Co. of Chicago will prepare a report on estimated traffic and revenues.

The Mystic River Bridge Authority has $100,000 for preliminary activity. Blueprints in the authority's office show two large spans over the river; one 100 ft. above high water to cross the South Channel nearer the Boston side, and the other 135 feet above high water over the main stream near the Naval Hospital on the Chelsea bank.

Of steel and concrete, the bridge will start near City Square in Charlestown, with a 3.8 percent grade upward. There would be 14 spans on the Charlestown side and 14 on the Chelsea side.

Condemnation of land for the project is expected to start next month. At present a 10-cent toll is expected to pay for the bridge over a term of years. In addition to this bridge, a second traffic tunnel to East Boston is planned.

AGC meeting sees biggest year ahead, hears warnings on labor shortages

Associated General Contractors at Chicago session given encouraging reports on materials—Seat F. W. Parrott as president

The construction industry faces the biggest year's work in its history, but the question of whether it can command sufficient labor to meet this challenge now poses the most serious problem to contractors, members of the Associated General Contractors of America, Inc., were told last week.

Meeting for their 28th annual convention at the Stevens Hotel in Chicago, AGC members heard government and industry spokesmen predict dollar-volume for building for 1947 ranging between $20,000,000,000 and $22,000,000,000 and got reports that remaining governmental controls over the industry might soon be lifted as supplies of construction materials increase. But the problem of increasing the number of skilled mechanics and the general labor pool overshadowed other topics at the general meeting.

John L. Haynes, chief, construction division, U. S. Department of Commerce, expanded on his organization's recent prediction (*ENR* Jan. 2, vol. p. 1) of a $20,000,000,000 to $22,000,000,000 construction volume for 1947, by breaking the figures down to include $15,000,000,000 of new construction and about $6,000,000,000 in carry-over from last year.

Costs hold volume down

"The increase in physical volume," Mr. Haynes added, "is not as great as the dollar figures would indicate. In terms of bricks laid and nails driven, the $22,000,000,000 in 1947 is less than the peak of $18,000,000,000 in 1942. In fact, this year's construction volume expressed in tons of structure is just under 1941, when we chalked up a $15,000,000,000 total.

"It's a healthy sign that private capital is taking the initiative and accounts for 77 percent of the money to be spent."

With respect to the supply of building materials, Mr. Haynes said he believes that there will be enough to supply the predicted demand, although the distribution picture will remain somewhat spotty. He was joined in this opinion by Welton A. Snow, division manager, who told the convention's building division that production for 1947 would meet construction demands, except for the items of cast-iron soil pipe, cast-iron and steel tubs and lavatories. His figures on these items showed that minor shortages can be expected, with the single exception of tubs, where the supply is now estimated to be 95 percent behind demand.

Frank R. Creedon, national housing expediter, also called attention to the increasing supplies of building materials, and to the recent upward revision of ceilings on non-residential construction to $50,000,000 weekly. (*ENR* Jan. 30, vol. p. 161). He added that complete relaxation of governmental controls on construction might be eliminated, depending on the appearance of adequate supplies of materials and labor.

Labor scarcity stressed

The most optimistic report on the labor situation was submitted by Richard J. Gray, president of the AFL Building and Construction Trades Council, who said that "adequate expansion and acceleration" of apprentice training can be expected as the materials situation improves. His opinion, however, was sharply questioned from the floor.

In his earlier report, Mr. Snow quoted figures to show that there are at present 1,600,000 employed workers in construction, and about 87,000 apprentices in training. In addition, he said, there are 250,000 or more non-union building craftsmen. He predicted shortages in the supply of skilled labor, particularly in the trowel trades.

To counteract an impending net loss among the 1,100,000 skilled mechanics in the construction trades, the convention passed a resolution urging prompt action by local joint apprenticeship committees to expand quickly the present total of apprentices.

Accelerated programs of this type were urged by W. J. Barney, chairman of the committee for apprenticeship, who called attention to the increasing average age of workers. Citing the figure of 90,000 apprentices in training for comparison, Mr. Barney said that some 5½ percent of all construction workers —or about 96,000 men—are now 65 years of age or older.

On the important problem of portal-to-portal pay suits, Mr. Gray told members that the AFL will advise membership not to institute such suits because they would have a "very destructive effect upon the economic life of our nation. The ramification of these suits . . . will extend right back to the men who are instituting them."

Equal rights asked

In accordance with several resolutions, the organization will urge the Building and Construction Trades Department again to take immediate steps for settlement of jurisdictional disputes and to eliminate restrictive practices.

In response to a request for guidance from Forrest W. Parrott, chairman of the committee on legislation, the convention later passed a resolution recommending to Congress the following changes in existing labor laws:

***AGC Officers**—Leaders of the Associated General Contractors pause during Chicago convention for a brief conference. Left to right: H. E. Foreman, managing director; Warren S. Bellows, Houston, Tex., retiring president; Forrest W. Parrott, Sioux City, Iowa, incoming president; and Dwight W. Winkelman, Syracuse, N. Y., incoming vice-president.*

AGC meeting

(*Continued from page* 55)

(1) Equal responsibility on employers and employees; (2) free speech for employers; (3) protection for employees against exploitation and coercion; (4) exclusion of supervisory and administrative employees from union agreements; (5) outlawing of secondary boycotts and sympathy strikes; (6) definition of compensable working time as a matter of employer-employee negotiations; (7) repeal of mandatory provisions of the Fair Labor Standards Act requiring assessment of penalties, such assessments of penalties to be left to the discretion of the courts; (8) a limit of one year within which claims can be sustained for back pay, and (9) settlement of claims to be legal and binding on both parties if arrived at by mutual agreement.

Highway Needs

Thomas H. MacDonald, commissioner of public roads, presented a paper showing the current need for highway improvement and estimated construction materials needed for 1947. According to PRA estimates there are 27,000 miles of federal aid highways that need reconstruction, 14,000 miles of two-lane pavement that should be improved to carry four lanes of traffic and 65,000 miles of other state highways in need of reconstruction.

Reports from the state highway departments indicate that a total of 400,000 tons of structural steel will be required for the 1947 road and bridge construction program.

An estimated 16,646,000 barrels of cement will be needed for the 1947 highway program, with the present scarcity in some sections of the country continuing through the first quarter of 1947. Assurance has been given that ample bituminous materials for highway work will be available this year, he said, but the lumber requirements—estimated to total 165,000 M. ft.—will result in this material continuing to be hard to get until later in the year.

At the division meeting of the highway contractors, Commissioner MacDonald emphasized the necessity of securing rights-of-way quickly and in sufficient quantities to avoid serious strangulation of the urban express highway program.

Moreover, he declared, if such rights-of-way were financed out of separate funds, it would nearly double the amount of urban highway construction that could be performed under the present program. As an example, he cited the recently inaugurated plan of Cincinnati, Ohio—a pioneer movement in acquiring right-of-way to speed city and urban highway construction.

Under this plan the city's purchasing commission will purchase the right-of-way for all phases of redevelopment, including street and highway construction. Activities of the purchasing commission are financed by a property tax. Such a plan not only avoids delays usually encountered in starting highway construction in urban areas, but it also makes possible the allotment of annual income for construction, while the purchase of right-of-way can be amortized on a long-term basis, the commissioner said.

Bureau of reclamation program

If Congress approves the President's request for funds for the Bureau of Reclamation, we expect to spend some $200,000,000 on construction during 1947, declared Kenneth Markwell, assistant commissioner of reclamation. About one-fourth of this work is under contract now, with the remainder to be placed under contract this year.

Highlights of the bureau's current construction program include such major milestones as the topping out of Anderson Ranch Dam during 1947, together with concentration on appurtenant features of the project, including the power plant. Some 20 miles of the Friant-Kern Canal will be completed this year, with construction to be started on an additional 26 miles of the canal.

One impelling force behind immediate reclamation development, said Mr. Markwell, is the urgent demand for veterans' settlement opportunities. In this connection construction work is being expedited to permit offering 50,000 additional acres of homesteads this year. On February 14, 1947 the Yakima-Tieton Irrigation Project, in Central Washington, will celebrate full payment of construction costs. This retirement of costs, five years in advance of schedule, is significant in that Yakima-Tieton is the first irrigation district to complete its 40-year payment in the 44-year history of the Bureau of Reclamation.

Housing for army personnel

A substantial contribution to civilian housing will result indirectly this year by a program being initiated by the Corps of Engineers under which surplus military installations will be dismantled and the materials used principally in the conversion of existing barracks to family quarters, according to Lieut. Gen. Raymond A. Wheeler, chief of engineers, U. S. Army.

It now looks as though the Corps of Engineers will spend about $190,000,000 for flood control and $105,000,000 for river and harbor construction during the current fiscal year ending June 30, 1947, continued General Wheeler.

In addition, appropriations made prior to July 1 of last year and carried over into the current fiscal year, together with current appropriations, after deducting the $295,000,000 construction program ending July 1, 1947, will leave a net carry-over appropriation on that date of $226,172,000 that is specifically earmarked for projects held up by the curtailment program. This part of the program covers 68 flood control projects on which construction is expected to be started this spring or early summer, and 35 river and harbor projects.

Virtually all Navy construction will be returned to the prewar competitive-bid system, if legislation soon to be offered to Congress is approved, declared Commodore Charles T. Dickeman, C.E.C., U.S.N. Architectural and engineering contracts for such work, however, may continue to be of the negotiated type, with a maximum six-percent fee. Incorporated in the pending legislation is a provision for spreading the work as widely as possible.

Contingent upon the allotment of adequate funds, said Commodore Dickeman, the Navy plans to replace several temporary shore-based facilities with permanent structures, both at home and abroad. The Bureau of Yards and Docks at present is conducting research and exploring such possibilities as underground construction, blast-resistant and atomic-radiation-proof buildings, new dispersion patterns, including duplicate key facilities, and new types of buildings which are more economical to construct and weather resistant.

New officers and awards

Forrest W. Parrott, vice president of the C. F. Lytle Co., Sioux City, Iowa, is the newly elected president of the AGC, succeeding Warren S. Bellows, of Houston, Tex. Dwight W. Winkleman, Syracuse, N. Y., was elected vice president.

Henry A. Reniger, president, Michigan chapter, AGC, Lansing, received the "Constructiondizing" award for achievements in labor relations, apprentice training, public relations and market development.

Other awards, presented annually for safety in construction, were made to the following contractors: Shackelford trophy, in the building division, to Couse and Westphal, Detroit; Zachry trophy, in the highway division, to the Bellefontaine Development Co., Bellefontaine, Ohio; and the Swenson trophy, in the heavy construction division, to the Newberry Electric Corp., Los Angeles. By winning the Swenson trophy for three consecutive years the Newberry Electric Corp. will retain possession of it.

Georgia political mix-up retards highway work

Georgia's political situation, with Herman Talmadge being named as governor by the General Assembly and M. E. Thompson, regularly elected lieutenant governor and taking the oath of office as acting governor, has retarded the normal functioning of the state highway department and resulted in delay in requesting bids for many projects which have been programmed for the year. No contracts have been let since last October for the state constitution forbids awards within 90 days of a change in administration.

The state has two claimants as director of the highway department, James L. Gillis, appointed by Mr. Talmadge, and Warren Neel who was named by Mr. Thompson. Mr. Gillis has taken over the office of George T. McDonald, retiring director, and has named M. L. Shadburn as state highway engineer and Sims Garrett as treasurer of the department. Mr. Gillis has been confirmed by the state Senate and is carrying on the operation of the department, while Mr. Neel has set up offices with Mr. Thompson.

The situation is not likely to clear until the court decision and interpretation of the state constitution as to who is the legal governor.

Reports that $31,000,000 of state highway funds have been tied up are not entirely correct. All of the 1946 federal funds have been programmed and only $1,584,513 of the 1947 federal funds have been put into the program. Also there are federal funds of $1,511,248 for secondary roads available in the 1947 program. Contracts for use of these funds have not been let but plans are being made for the projects.

Georgia has a highway program calling for 634 miles of paving, about 50 miles of grading, and 114 bridges for an expenditure of $28,368,744 which is available for contracts.

Mr. Gillis said that Mr. Shadburn has succeeded Col. M. E. Cox as highway engineer but that Colonel Cox has been appointed as assistant to the director and is now coordinating the operations of the department.

Mr. Shadburn has been with the highway department since 1933 when he was assistant director of the planning division. He was state highway engineer in 1941-42 when he resigned to become engineer with the Sam Finley, Inc.

Although the political pot is boiling and the results will affect the membership of the highway commission and the director of the department, there have been no changes in the regular personnel.

Resignation of Hydro head asked

Resignation of Thomas H. Hogg, internationally known hydraulic engineer and chairman of the Hydro Electric Power Commission of Ontario since 1937, has been demanded by Premier George Drew of Ontario.

Premier Drew announced his demand for Mr. Hogg's resignation in a province-wide radio broadcast on Jan. 27, charging that Mr. Hogg persistently refused to communicate "essential information" to the government. The chairman has "obviously got into the unfortunate habit of keeping important information entirely to himself," Mr. Drew added. It was alleged further that on several occasions, Mr. Hogg had left his fellow commissioners completely in the dark with regard to the recent emergency situation regarding the supply of power in southern Ontario.

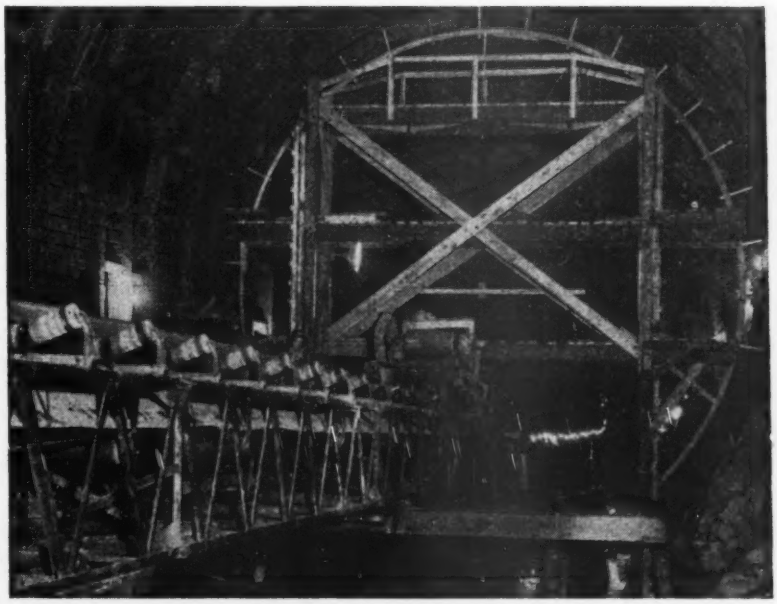
"In view of this," Mr. Drew concluded, "after all the earlier efforts to establish business-like methods, the government had no possible alternative but to come to the final conclusion that a change in the management of the Hydro Electric Commission was an immediate necessity in the public interest."

Mr. Hogg has spent almost all his professional life in the service of the "Ontario Hydro," following a year on the staff of the old *Canadian Engineer* and service with the Ontario Power Co., at Niagara Falls. Appointed assistant hydraulic engineer in 1912, he advanced to become chief engineer of the commission in 1934 and chairman in 1937. Since he became chief engineer to the commission, the organization has more than doubled in size until it is today the largest publicly owned utility enterprise of its kind in the world.

Mr. Hogg's predecessor as chief engineer, F. A. Gaby, was summarily removed from his post in 1933 by the then Premier of Ontario, who headed a provincial government of the opposite political complexion to that now headed by Premier Drew.

New Mexico shifts roads personnel to handle work

Fred G. Healy, construction engineer of the New Mexico highway department, has been given a special assignment as urban engineer in charge of advance engineering studies and surveys in connection with urban highway projects. He will work with urban engineers of the Federal Public Roads Administration. Healy recently returned to the department.



***Watauga Dam Concreting**—Concrete for the invert of the diversion tunnel of Watauga Dam is carried into place by a belt conveyor, as work proceeds on the war-deferred project. The dam, on the Upper Holston River, above Elizabethton, Tenn., is being built by the Tennessee Valley Authority with its own forces. Some 1,200 men are now at work on the 318-ft. high rock-fill dam structure and appurtenant works.*

Random Lines from an editor's notebook . . .

. . . . In which is reported how an architect helps California highway bridge designers to achieve sound architectural effects

Highway bridge designers in California are assisted in their work by an architect, not in the detailing of structural members, but in helping to achieve sound architectural effect.

The California Division of Highways' bridge department is one of several such organizations in this country in which good use of architectural talents is made.

The architect first makes perspective drawings of designs as prepared by the engineers. He then studies the bridge and tries to achieve good proportion without changing the fundamental features of design. If he feels a change is necessary, he registers his complaint and, if the engineers agree, the design is changed accordingly. To assist in the development of minor bridge parts the architect also spends much time on the study of details such as railings, curbs, and transitions.

H. C. van der Goes, the architect in this case, started work for the California Division of Highways bridge department in 1942 after a successful career as an architect in the Midwest and in southern California. He received his early training in his native Holland where he studied structural engineering until he changed to architecture because of a prize won in a minor architectural competition. Besides work in his profession, Mr. van der Goes' experience in this country includes work on bridge and building construction. So when the job in the bridge department was open, he was well qualified to fill it.

His starting assignments at the state capital included the preparation of perspective drawings of bridges to accompany plans so that the state highway commission and other public groups, unaccustomed to reading engineers' blueprints, would be able to see a proposed bridge. This gave him a chance to apply his architectural talent on the bridges before they were built or even advertised. Although many bridge designs are intrinsically beautiful (long suspension bridges and high concrete arches, for example), if care is not exercised on the design of some of the ordinary type viaducts and overpasses, they can easily become an eyesore.

Drawings and design

As time went on Mr. van der Goes' architectural drawings not only helped in interpretation of proposed bridges for those not technically trained, but they also influenced the work of designers who became more aware of the architectural aspects of their work. When as a result architectural suggestions were required less frequently, Mr. van der Goes started studying some of the many minor bridge features that affect the finished product. Some of these are bridge railings, the window dressing which effectively influences the public acceptance of a bridge; piers; curb and drainage details, including placing a drip cutter or notch on the underside of a concrete bridge to prevent discoloration from water; and improvements of underpass proportions to allow for maximum sight distance.

The bridge department of California Division of Highways is under the direction of F. W. Panhorst, bridge engineer. . . . *L.L.W.*

New examination for Navy C. E. Corps billets

A new examination will be held in May for civil engineers seeking appointment as junior grade lieutenants in the Navy Civil Engineers Corps, the Bureau of Yards and Docks announces.

The examination was scheduled after the bureau received indications that many applicants had failed to get adequate notice for the test to be given this month. Seventy billets are open.

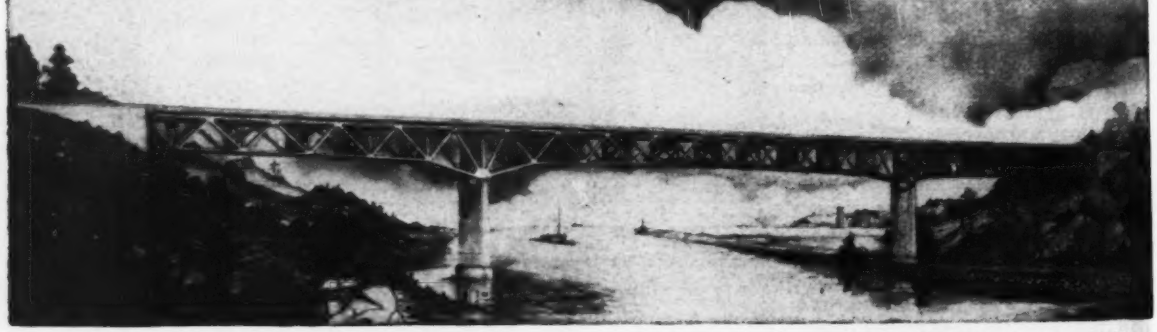
Candidates must be between 22 and 30 years old, graduates of an accredited engineering college or university, have had three years professional experience in engineering, or related active military service, and must be citizens of the United States. Those who will have completed the three years experience or service by July 1, 1947, may be accepted. Applicants can obtain full details from the Naval Officer Procurement office in their area.

Canadian army keeps Alaska highway in shape

A group of Canadian Army personnel is keeping the Alaska highway in repair since maintenance of the road between Edmonton and Alaska became the Dominion government's responsibility last April 1.

Army officials said 700 army personnel—volunteers for the job—were keeping the road groomed for the time when it will become an integral part of the highway system of Canada.

Commercial traffic is fairly heavy on the highway built during the war by United States and Canada when a Japanese attack against Alaska appeared a possibility. However, civilian and tourist traffic has been light despite the easing of restrictions.



Cooperative Job—*A perspective drawing such as this, made by a California Highway Department architect, helps contractors, highway commissioners, taxpayers and engineers visualize the appearance of a proposed bridge.*

Dorena Dam bids to be opened March 20

Bids for construction of the Dorena Dam and spillways, third in the series of Willamette Valley flood control project dams in western Oregon, are being called for by the U. S. Army Engineers to be opened March 20.

Cost of the work is estimated at $5,740,000. The dam, to be located on Row River, six miles southeast of Cottage Grove, will be of the earth-filled type with a crest 4650 ft. long and a height above foundation of 145 ft. It will impound 79,000 acre-ft. capacity.

Quantities involved include 473,000 yds. common solid rock and channel excavation; 2,932,500 yds. embankment; 160,575 cu. yds. concrete; 1,375,000 lbs. reinforcement steel; 4,000,000 cu. yds. borrow excavation, and 214,000 cu. yds. stripping.

Cost of the entire Dorena project is estimated at $9,000,000.

Canadian universities to do much building

Canadian universities plan to spend $30,000,000 on new building in the next 10 years from blueprints already drawn. $50,000,000 worth could be built in the same period, a coast-to-coast check revealed, but the extra $20,000,000 is lacking.

Extensions to science faculties and whole new buildings, highlighted by McGill's proposed cyclotron and radiation laboratory, reflect a countrywide desire to remain abreast of latest developments.

McGill in Montreal has a $9,114,000 program on the books, of which $5,741,150 already is under way. University of Toronto, whose long-range plans envisage creation of a city within a city, with 11 new buildings projected, besides alterations to 60 existing ones, comes second with a budget of $7,700,000. McMaster University in Hamilton, Ont., and the University of Alberta in Edmonton each plan outlays of $5,000,000, while the government of British Columbia has voted a similar amount for new construction at the University of British Columbia.

For construction of its new medical school and main building, Ottawa University will spend $1,500,000. Proposed extensions and alterations at Queen's in Kingston, Ont., topped by the building of $375,000 McLaughlin hall for mechanical engineering, come to $1,295,000. University of New Brunswick's budget of $570,000 includes a new science building.

Veterans retain rights for prefab materials

Prefabricators who received priorities assistance for building materials under the Veterans Emergency Housing Program must continue to give veterans preference for prefabricated houses, and sections or panels produced with these materials, Housing Expediter Frank R. Creedon has announced.

This fact is emphasized in an amendment to Housing Expediter Priorities Regulation 6 which becomes effective immediately. This amendment also contains changes in the priorities assistance system for prefabricators.

Veterans' preference for prefabricated housing is continued in effect by requiring prefabricators to honor all HH priorities issued before Dec. 24, 1946. However, under the new permit system, non-veterans are now entitled to buy prefabricated housing if a prefabricator or dealer does not have any HH rated orders on hand.

HEPR 6 points out that under the new Housing Permit Regulation any person eligible under the Veterans' Emergency Housing Program to erect a prefabricated house may apply for a "construction permit" to erect a prefabricated house or section. Eligible persons include non-veterans building for their own occupancy, who may then place unrated orders for prefabricated housing.

Pipe Cover—*Clay channel (half-round) pipe serves a new use at Birmingham, Ala., where workers for the Birmingham Electric Co. have used it to cover underground steam lines in downtown areas. Installation is made by laying a slab of concrete 4 to 5 in. thick in the bottom of the trench, and conventional hollow tile is placed atop the concrete to form the sides of the trench. The insulated steam line is then placed, and covered with the channel pipe, which is grouted firmly to the tile with mortar.*

Bechtel Corp. succeeds Bechtel Bros. McCone Co.

The name of Bechtel Brothers McCone Co., engineering and construction organization, has been changed to Bechtel Corp. At the same time, three subsidiaries became respectively Bechtel International Corp.; Compania Bechtel, S. A., and International Bechtel, Inc.

The change was made, it was announced, in the interest of simplification and convenience. The organization's policies and the scope of its services will remain as in the past.

Principal officers are S. D. Bechtel, president; W. E. Waste, Van W. Rosendahl, J. Perry Yates, V. G. Hindmarsh, Jerome K. Doolan, and C. Stribling Snodgrass, vice-presidents. Headquarters and major engineering offices are located in San Francisco, Calif., and an engineering staff is maintained in Los Angeles.

Montana considers big building program

The first measure of general interest to be introduced in the 1947 Montana legislature would allocate $4,262,861 for a statewide construction and rehabilitation program.

The 1945 session set aside $4,500,000 from a general fund surplus for postwar construction and a special commission has operated during the interim to study requests of state institutions for portions of this fund.

The final recommendations, as contained in the bill, provide $1,787,285 for six educational institutions, $679,946 for seven custodial institutions, $530,630 for the state tuberculosis sanitarium, $615,000 for a new state office building and $650,000 for the revolving fund of the state water conservation board.

Voters last November authorized expenditure of $2,000,000 for new construction and repairs at the state hospital for the insane and a measure is expected to be introduced at this session calling for a $350,000 bond issue, to be retired by land grant income, the proceeds of which would be added to the postwar planning commission allocation for the new state office building.

John Paul Jones of Seattle has been retained by the state as consulting architect for four main buildings to be erected at Eastern Montana Normal School, Billings; Montana State College, Bozeman; Montana State University, Missoula, and Northern Montana College, Havre.

Pan American Sanitary Bureau elects Soper

Dr. Fred L. Soper of the Rockefeller Foundation has been elected director of the Pan American Sanitary Bureau to succeed Dr. Hugh S. Cumming, who has held that post for 26 years. Dr. Cumming will continue to serve as director-emeritus.

Dr. Soper has been a member of the staff of the International Health Division of the Rockefeller Foundation since 1920, and has been engaged on public health problems in all parts of the world. He holds degrees from the University of Kansas, Rush Medical College, and Johns Hopkins.

The Pan American Sanitary Bureau is a treaty organization that came into being in 1902 for the improvement of public health in the American republics. It is financed by pro rata contributions based on population of the participating countries. Among other things, the bureau has played a leading role in recent organization of the Inter-American Association of Sanitary Engineering.

Steps taken to reduce Lake Michigan pollution

Four steps for reduction of pollution of Lake Michigan have been announced by Attorney General Barrett of Illinois.

The action was part of Barrett's suit against 20 Indiana industries, the state of Indiana, and the cities of East Chicago, Gary, Hammond, and Whiting.

Under the agreements, work is to be started immediately on these projects: Inland Steel Co. will erect its own million dollar sewage treatment plant for its East Chicago works; the Sinclair Oil Co. will install $750,000 oil separators; The Shell Oil Co. of East Chicago will continue development of the sewage system now connected to the Hammond system, and the American Maize Products Co. will spend $100,000 for additional equipment to end discharge of wastes.

To abate Buffalo River pollution

A program for abatement of Buffalo River pollution caused by the discharge of industrial wastes has been recommended by Dr. George E. Symons, consultant.

Basic parts of the program include the adoption of a project to obtain water direct from Lake Erie for use as cooling water by the Socony Vacuum, National Aniline, General Chemical, Republic Steel and Donner-Hanna plants. The estimated cost of the project is $2,400,000.

Salt Lake County agrees to finance sewer work

A new procedure for financing the construction of sewage disposal facilities in Utah was approved by the Salt Lake County Commission when members agreed to handle a $2,750,000 revenue bond program through local brokerages.

The project, involving 100 miles of sewer lines, a $300,000 disposal plant and serving 6,000 customers, will be paid for by service and connection charges. Property owners in the county's unincorporated territory will pay $149 and $2 per month.

Let extension contract for Coachella Canal

Construction of another 7.8-mile section of the Coachella Canal in California, has been placed under contract by the Bureau of Reclamation. Eighty-seven miles of the canal have already been built, and construction of 29.2 miles is now under way. With the completion of this work, and the present contract, 124 miles of the 145-mile irrigation facility will have been completed.

The canal is part of the All-American Canal System which will deliver Colorado River water to about 75,000 acres of land in the Imperial and Coachella Valleys in southern California.

The section of the canal to be constructed is near Idaho, Calif.

Eight bids were received. The contract was awarded to Otto B. Ashbach and Sons, St. Paul, Minn., the lowest bidder, at $697,700.

MAJOR MEETINGS

Associated Equipment Distributors, 28th annual meeting, Edgewater Beach Hotel, Chicago, Ill., Feb. 13-15.

American Road Builders Association, annual convention, Palmer House, Chicago, Ill., Feb. 17-21.

American Concrete Pipe Association, annual national convention, Statler Hotel, St. Louis, Mo., Feb. 23-25.

American Concrete Institute, 43rd annual convention. Netherlands Plaza Hotel, Cincinnati, Ohio, Feb. 24-26.

National Council for Stream Improvement, annual meeting, Waldorf Astoria Hotel, New York, N. Y., Feb. 24-26.

American Society for Testing Materials, Committee Week, Benjamin Franklin Hotel, Philadelphia, Pa., Feb. 24-28.

Association of Highway Officials of the North Atlantic States, 23rd annual meeting, Hotel Traymore, Atlantic City, N. J., Feb. 26-28.

Bill names USPHS as stream-clearing head

A new federal bill (HR 315) introduced early this month provides for water pollution control activities under the direction of the U. S. Public Health Service which would act as a coordinating and stimulating agency in the field of pollution abatement.

Under the terms of the bill, numerous powers and duties are granted with regard to the development and presentation of a comprehensive nationwide pollution abatement program.

In addition, the bill provides $100,000,000 per year for grants-in-aid (not to exceed 33⅓ percent of the cost) and loans for the construction of treatment works. An additional $1,500,000 per year is authorized for grants to states and interstate agencies for promotion, investigations, and surveys in connection with pollution abatement.

The bill is essentially the same as HR 4070 of the 79th Congress, the principal change being a provision giving the Surgeon General the right to bring suit, after due notification, in federal court when the state or inter-state agency has failed to act.

Adm. Draemel to direct stream clean-up in Pa.

Rear Admiral Milo F. Draemel, U. S. N., retired, has been named Secretary of Forests and Waters in the cabinet of Governor James H. Duff of Pennsylvania, who in announcing the appointment said Admiral Draemel will supervise the gigantic stream cleanup program started under Governor Martin who resigned the governorship to take over his seat in the United States Senate.

The State Sanitary Water Board, Mr. Duff said, will be transferred from the Department of Health to the Department of Forests and Waters and will function under the direction of Admiral Draemel. The board has ordered more than 700 Pennsylvania municipalities and industrial firms to draw up plans for sewage plants.

Admiral Draemel, 62, is a native of Fremont, Neb., and a present resident of Wynnewood, Philadelphia suburb. He was stationed at Pearl Harbor when that base was attacked by the Japanese on Dec. 7, 1941. He immediately became chief of staff to Admiral Chester W. Nimitz, serving in that capacity for six months until he was named commandant of the Philadelphia Naval Base. He retired from the Navy in August, 1946, to become vice-president of Temple University, Philadelphia.

OBITUARY

William D. Manchester, died in Topsfield, Mass., Jan. 26. He had worked in South America for the Guggenheim Corp., and since 1920 had been engineer and vice-president of the Lynn Sand and Stone Co., Lynn., Mass.

Allen J. Saville, 58, president of Allen J. Saville, Inc., died Jan. 20 at Richmond, Va. A graduate of the University of Virginia, he was assistant city engineer of Richmond from 1909 to 1913, and in 1921 he became director of public works there. He later did engineering work for many Virginia cities. He designed the Robert E. Lee bridge over the James River.

Howard M. Gassman, 70, died in Birmingham, Ala., Jan. 14. For about 40 years prior to his retirement, he was a consulting engineer for the Tennessee Coal, Iron & Railroad Co.. and later maintained a private consulting engineering office.

Ernest S. Alderman, 60, assistant engineer of the planning survey of the Oklahoma State Highway Department, died Jan. 9. He had been with the department since 1919, having gone to Oklahoma as a senior highway engineer for the Bureau of Public Roads.

William A. Robertson, 80, died at Chocolate Lake, N. S., recently. An engineer for more than 35 years, he had been chief engineer of the Canadian government geodetic survey.

George MacLeod, 60, assistant district engineer, Provincial Public Works Department, New Westminster, B. C., died there recently. He helped build the Grand Trunk Railway in western Canada.

Richard Cokinham, 71, city engineer of Utica, N. Y. in the administrations of three mayors, died Jan. 24. He studied at Hamilton College, and for 17 years served in the west with the U. S. Coast and Geodetic Survey, having been division engineer on the Snake River Dam construction and chief engineer on the construction of several irrigation dams in Arizona.

Henry G. Avers, 60, chief mathematician of the Division of Geodesy of the U. S. Coast Geodetic Survey in Washington, D. C., died in that city Jan. 19. Mr. Avers, who was secretary of the division of surveying and mapping of the American Society of Civil Engineers, joined the survey in 1908.

Robert R. L. Bullard, 56, a civil engineer who had worked with the Office of Price Administration in Washington, D. C., during the last two years and with the Treasury Department for 10 years, died at Takoma Park, Md., Jan. 22. Mr. Bullard studied civil engineering at Rensselaer Polytechnic Institute, and previous to government service.

Frank S. Bailey, 74, a civil engineer for Stone & Webster of Boston, died Jan. 21 at Braintree, Mass. In 1914-15 he worked on construction of the Massachusetts Institute of Technology buildings in Cambridge, and was formerly connected with the Brockton, Mass., city engineer's department and with the firm of Metcalf & Eddy.

Daniel J. Ryan, 67, retired engineer for the Metropolitan District Water Commission, Died Jan. 21, in Haverhill, Mass.

Arthur William Deuel, 63, former president of the San Francisco Bay Toll Bridge Co. and one of the engineers in charge of constructing the San Mateo-Hayward bridge, died in San Mateo, Calif., Jan. 3.

Roy L. May, 59, Hanford, Calif., consulting engineer, died Jan. 19. He was engineer for the Tulare Lake Basin Water Storage District.

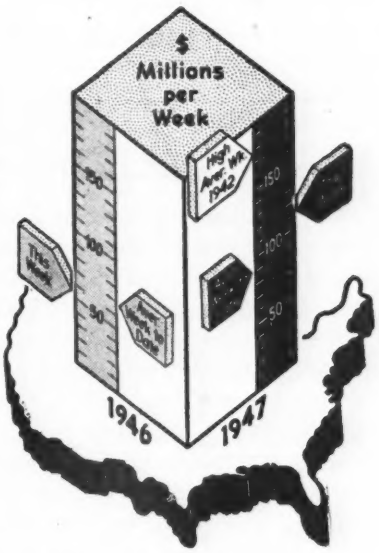
Raymond P. Webb, 62, civil engineer, a 1908 graduate of Stanford University, and secretary-treasurer of the Engineering Service Corp. of California, was killed in a traffic accident in Los Angeles, on Dec. 30.

J. O. Johnson, 60, president of the Ben Sira Corp., sewer and street construction firm, Dallas, Tex., died Jan. 4. He had been with the firm since 1940 and was a director of the Municipal Contractors Association.

John Hancock Lance, 70, of Chase, Pa., died recently. He was graduated in civil engineering at Cornell University in 1896. From that year until 1919 he was chief engineer of the Spring Brook Water Co., when he resigned to enter consulting practice with his brother, William L. Lance. While with the Spring Brook Co. he designed and supervised the construction of the Nesbitt Dam, the highest masonry dam in Pennsylvania and the Pike's Creek Reservoir and aqueduct—which has been for many years the state's largest storage system.

For Men and Jobs and Elections and Activities, see pages 110 and 120.

CONSTRUCTION ACTIVITY



As Reported this week to...
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only
(Thousands of Dollars)

	Week of Feb. 6 1947	Cumulative 1947 (6 wks.)	Cumulative 1946 (6 wks.)
Federal	$9,314	$52,502	$42,584
State & Mun.	24,094	131,961	87,109
Total Public.	$33,408	$184,463	$129,693
Total Private	78,138	358,053	274,111
U. S. Total..	$111,546	$542,516	$403,804

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1947 (6 wks.)	Cumulative 1946 (6 wks.)
Waterworks	$551	$15,409	$6,346
Sewerage	4,310	12,244	3,047
Bridges	4,557	14,130	12,289
Highways	11,671	50,236	45,767
Earthwork, Waterways	554	9,248	28,105
Buildings, Public.	7,921	59,363	25,094
Industrial	27,776	105,456	114,736
Commercial ...	41,199	228,966	143,798
Unclassified	13,007	47,464	24,622

NOTE: Minimum size projects included are: Waterworks and waterway projects, $22,500; other public works, $40,000; industrial buildings, $55,000; other buildings, $205,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1947 (6 wks.)	Cumulative 1946 (6 wks.)
NON-FEDERAL	$120,554	$114,682
Corporate Securities	5,868	56,558
State and Municipal	114,686	58,124
FEDERAL	.....	158,320
Total Capital	$120,554	$273,002

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost..	Feb. '47	390.76	187.84
Building Cost.....	Feb. '47	297.38	160.75
Volume	Jan. '47	195	86

EDITORIALS

VOLUME 138 NUMBER 6

February 6, 1947

Opportunity Unlimited

IN HIS ARTICLE on low-cost linings for irrigation canals, Walker R. Young, chief engineer of the Bureau of Reclamation, emphasizes the urgent need for more economical canal pavements, and offers an unusual challenge to the construction industry and materials producers to find a solution to the problem. Because the need for low cost is greatest for small canals, whose aggregate lengths are measured in thousands of miles, the opportunity for good and for gain is almost unlimited. Moreover, the opportunity is present in both materials and equipment. One has only to consider the huge amounts of money being invested in water storage, and then to realize that as much as one-third of the supply turned into 50 miles of unlined canal can seep away, to appreciate the economics of the situation. In addition there is the cost of draining adjacent land waterlogged from the seepage, as well as the expense of clearing weeds which grow profusely in unlined canals. Here is a fertile field for important engineering research, equipment evolution and construction technique development. Through its own research and through changes in specifications the Bureau of Reclamation is laying the groundwork for improvements. Beyond that the solution rests largely with the construction industry.

Designed to Serve

INGENUITY in application of structural details and materials can notably improve the operating economy and efficiency of buildings. A brief article elsewhere in these pages illustrates the point. To resist strongly corrosive conditions in a five-story meat-processing plant, the structural designer chose cast iron for interior columns. In addition, the use of small round columns of exposed cast iron took a minimum of floor space. Further benefits accrued when the designer adapted the columns to support flat, smooth-ceiling concrete floor slabs, which minimize dead air pockets and impose no obstacles to the installation of under-ceiling ducts and piping. These results were achieved by coordinating familiar design principles in sound combination to meet the functional conditions of meat processing. These principles, and others equally well known, can be applied to nearly any building design problem. By such imaginative, critical reasoning do structural designers improve the serviceability of their product.

A Word of Warning

ENTHUASIUM for dump-truck delivery of air-entrained concrete, notably successful under his own supervision, has inspired J. A. Nicholson, of Toledo, to extol its merits elsewhere in this issue. What he says for the practice is unquestionably valid on the basis of his own experience, and the method doubtless can be employed with equal success by any organization that devotes the same degree of technical skill and management ability to the task. There lies the restrictive qualification. Truck-mixers and agitators were developed to avoid the difficulties of concrete segregation in open body trucks. In now returning to that once frowned upon practice the principal new ingredient offered is entrained air in the concrete. This has been shown to reduce segregation and to contribute other valuable qualities to concrete, but new methods of mix design and control are necessary corollaries, and to master these, full knowledge and personal experience are prerequisites to success. Dump truck delivery of air-entrained concrete is an enticing prospect, but it must still be regarded as experimental by new converts and as requiring special supervision even by the experienced.

Useful Labor-Dispute Machinery

IN SETTING UP a national joint committees to function as court of last resort in labor-management disputes in the construction industry, the Associated General Contractors and the Building Trades Department, AFL, have, as President Truman said in his announcement, "taken a significant step forward in industrial relations". Beyond such characterization and praise it is unwise to venture until the committees planned for heavy construction, highway construction and building work exhibit by deeds that they can settle disputes; although it is to be hoped that they have few occasions to prove their worth since the place to settle disputes is at the local level.

Actually, under present conditions, with unions under attack in Congress and with wage rates higher than at any time in history, anti-strike or dispute-

settlement agreements are relatively easy to come by. It is good union strategy, and besides the men want to work rather than strike. Basically, the AGC-AFL accord is no more than an agreement to embrace voluntary arbitration after collective bargaining fails. No dispute has to be submitted to the committees, and none can be if "any non-union condition exists for any of the crafts" on the job of the contractor involved. These are shortcomings that seriously circumscribe the field of operation of the committees.

Again, it is by results that the proposed labor dispute machinery must be measured. If it disposes of cases quickly and fairly, while construction work continues, and if management and labor accept the decisions as final, the step forward will be truly "significant." If the committees fail in these respects, or even if decisions are acceptable to the disputants but are not in the public interest, the outcome will not be so happy. It is to be hoped that the construction industry, from which the nation expects and deserves so much, will not only make this newly created device work, but will regard it as only the first of other steps in the direction of improved labor-management relations.

Amending the Wagner Act

SINCE THERE IS reason to expect that the Wagner Act will be amended by the 80th Congress, engineers and other professional men should be ready at an early date to lay before it specific proposals designed to strengthen the standing of professional employees under that legislation. Unfortunately, most of the proposals put forward to date have been too general to be of any real value; others lack practicality due to misunderstanding of how the act functions.

A major source of misunderstanding is found in the fact that the National Labor Relations Board, when called upon to segregate one group of employees from another, does so on the basis of the jobs they are holding, not on the basis of their training.

The fact that the NLRB is concerned only with the job a man holds, not with his training, probably will make impracticable the proposal now being considered by the American Society of Civil Engineers of trying to include in the amended act a provision that would permit engineers-in-training to be grouped for collective-bargaining purposes with the men holding professional jobs of a type to which they aspire. However, as this grouping of men with professional aspirations with the subprofessional men with whom they are working is not as serious as some think, too much time should not be wasted in trying to find a way to avoid it. Nor should time be wasted in attempting to have bargaining groups made up of men doing professional work limited to men of professional training. In the past the NLRB has refused to do this, and with good reason. For example, when the NLRB has found that the employees in a research laboratory that is isolated from other operations of the same firm should have separate representation from other employees of that firm, it has included in that group the non-professionals in the laboratory on the ground that they have more in common with the other laboratory employees than with employees in like jobs in other plants of the same firm.

A further possible source of confusion that should be avoided in drafting amendments to the act rises from the widespread belief that registration as a professional engineer can be used as the line of demarkation between professional and subprofessional work. Here again, it is necessary to recognize that the NLRB acts on the basis of what a man is doing, not on what qualifications he has. On the other hand, in the difficult task of defining *professional work*, it may be possible to use the requirements of the model registration law as a guide so that, as a general rule, a man cannot fill a job classified by the NLRB as professional until he has met those requirements.

In conclusion it might be well to observe that, in general, professional employees have received fair treatment under the Wagner Act as it now stands. Consequently, in proposing amendments, or in supporting amendments put forward by others, care should be taken to see that the amendments will actually improve the position of professional men. Two essentials at this time are: definite authority for professional men to choose their own bargaining representatives; and a workable definition of professional work.

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Low Cost Linings for Irrigation Canals

Walker R. Young
Chief Engineer, Bureau of Reclamation
Denver, Colorado.

***Contents in Brief**—The urgent need of low-cost linings for irrigation canals is indicated by excessive amounts of seepage and the necessity for extensive drainage works on valuable lands adjacent to unlined irrigation canals. The Bureau of Reclamation is promoting an investigation into the development of new linings and construction methods which will encourage widespread use. Some of the new linings under consideration are: hydraulic cement mixtures, asphaltic materials, and earth materials. Further, the development of new machinery to combine all operations into one unit is being pushed. Progress along these lines will bring extensive economies in irrigation-canal costs.*

THOUSANDS of miles of irrigation canals in the western part of the United States fail to deliver a large proportion of the water turned into them at their intakes because of leakage from unlined sections. To reduce these losses of valuable water, the Bureau of Reclamation is conducting a broad program aimed at the development of lower cost canal linings. In this program the bureau, recognizing past performances of the construction industry in reducing costs and improving workmanship, appeals to the ingenuity of the contractor, the equipment manufacturer, and the materials producer for aid in developing satisfactory linings that can be installed at costs that are economically justified.

The long-felt need for lining irrigation canals is intensified today by the increased demand for irrigated land in the west and the growing necessities of conserving vital water supplies and of protecting productive lands from seepage. However, with the costs of lining canals by conventional methods and with orthodox materials now at levels that are prohibitive for many distribution systems, the bureau is looking beyond the precedent of the familiar trapezoidal canal section with its concrete lining and has begun to explore the possibilities of radically different designs, materials, and construction methods.

Through the comprehensive program recently initiated, the bureau hopes to develop lower cost canal linings that will permit the lining of hundreds of miles of new canals to be built in the present program as well as some of the thousand of miles of unlined canals now in service. The program comprises extensive laboratory research and field installation of different types of experimental linings and calls for the active cooperation of contractors, materials manufacturers, and equipment designers. To allow contractors and equipment firms more latitude in devising effective methods and machinery that will result in lower unit costs, canal designs are being modified and specifications broadened.

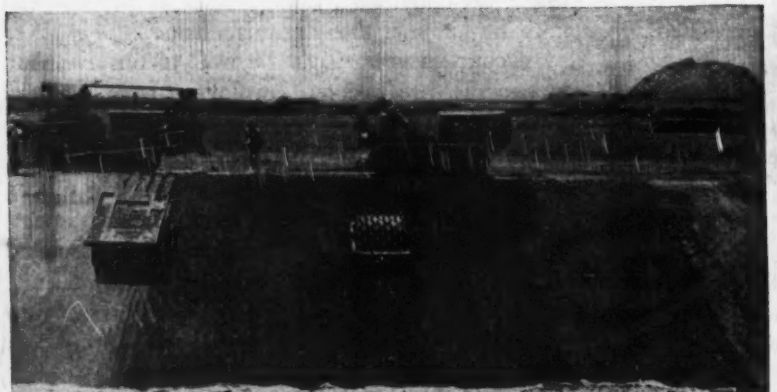


Fig. 1. Compaction for an experimental installation of soil-cement lining on the Altus Project in Oklahoma was obtained by using sheepsfoot and rubber-tired rollers which were drawn by using tractor hoists. The experiment demonstrated the need for efficient equipment for placing and compacting this type of lining.

Large water losses

For many years the bureau has recognized the importance of lining irrigation canals to reduce seepage. Loss of water from large unlined canals is known to amount to as much as one percent per mile or more than one-third of the total water diverted in fifty miles of canal. Losses from smaller canals, 100 cfs. or less, are even greater. Uncontrolled seepage eventually results in waterlogging of nearby fields and consequent wasting of land. As good land goes out of production, demands are made for construction of drains, and maintenance of an additional system of water channels becomes necessary. As a consequence, no small part of the annual budget of irrigation districts is used for the clearing of vegetation and silt from canals and drains.

The economic justification for lining any canal is influenced by many factors, which may vary considerably for different canals and local condi-

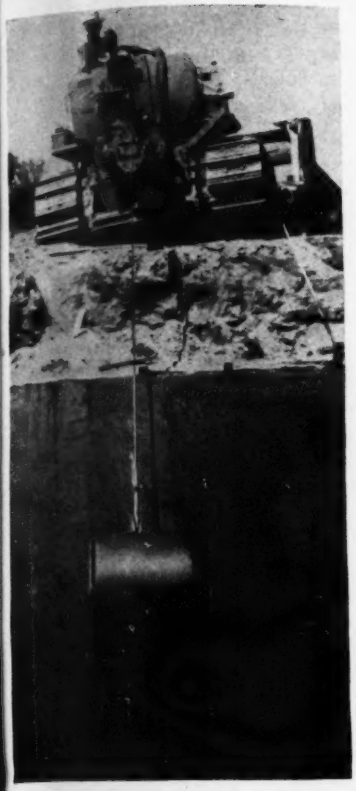


Fig. 2. Placing and rolling of asphaltic concrete canal lining will require specialized equipment.

tions. However, since the cost of the lining must usually be borne by the water users, this initial cost must be weighed against the serviceable life of the lining, and in most cases, the payment must be amortized over a period of years. Thus, a type of lining which will give 40 years of service without maintenance and costs $2.00 per sq. yd. to install, is more economical than a less-permanent type costing only $1.00 if the latter will have to be replaced in twelve years.

However, the high initial cost of standard types of lining is, at present, prohibitive for many projects. The need is great, therefore, for reducing the cost of canal lining or for discovering a satisfactory type of lining which at lower cost will still provide durability and serviceability. Accordingly, the bureau is intensively studying all ideas that have any promise for providing lower-cost, dependable linings.

Types of lining material already under consideration fall into three general groups, (1) hydraulic cement mixtures, (2) asphaltic materials, (3) earth materials. Hydraulic cement mixtures include concrete and mortar of portland cement and hydraulic lime with or without various additives. Structural variations include reinforced and unreinforced cast-in-place concrete and mortar, macadam and dry-tamped concrete, pneumatically applied mortar, and precast units. The use of hydraulic lime is expected to increase extensibility of the concrete, a characteristic highly desirable in canal linings. The addition of small amounts of asphalt emulsion or other plasticising agents should reduce the water content and therefore the shrinkage. The elimination of reinforcing steel, where design considerations will permit, will increase extensibility in addition to reducing unit costs. Asphaltic materials include asphaltic concrete (cast-in-place and precast), spray-applied asphaltic membranes, and prefabricated bituminous surfacing. The asphaltic membrane lining is essentially a stabilization of existing soil secured by the absorption of oils and cutbacks covered with a very thin membrane of a heavier asphalt. The earth materials include loosely placed, and compacted untreated earth, soil-cement and soil-resin mixtures, and bentonite and silt treated earth.

Construction costs are high

Although considerable effort will be spent attempting to develop lower cost lining materials, it is realized that the major portion of the total cost of canal linings is attributable to construction operations—handling of material, placing, compacting or finishing and curing. Construction operations, including labor, usually account for more than two-thirds of the cost of lining regardless of the type of material used. Therefore, the best possibilities of effecting economies lie in the development of mechanized equipment which will eliminate high labor costs and speed up construction operations.

In many of the unlined canals now in operation considerable trimming and backfilling will be necessary preparatory to any lining installation.

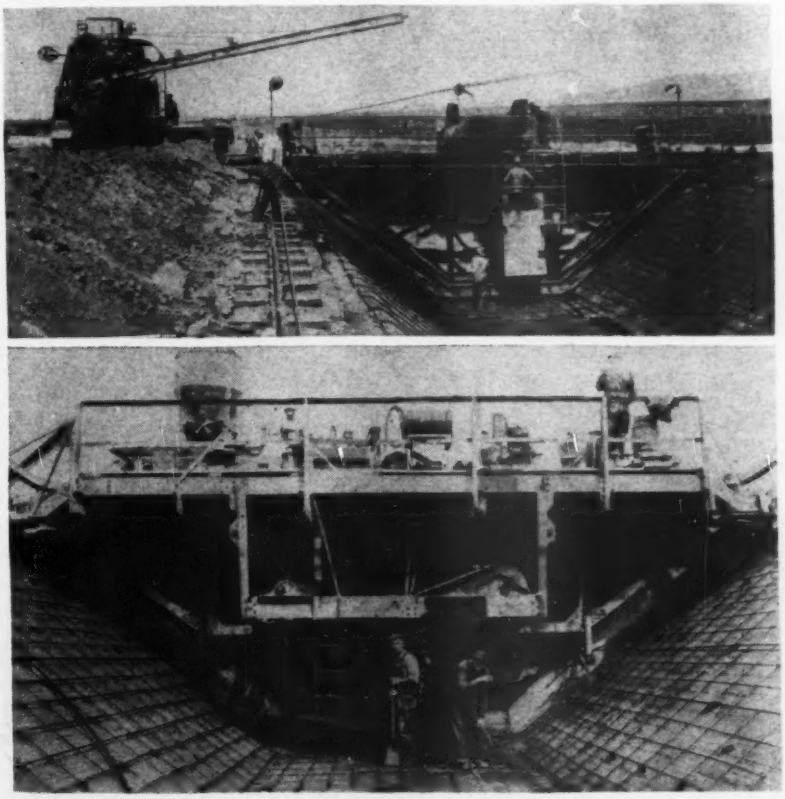


Fig. 3. The Clyde Wood (top) and Jahn and Bressi (bottom) machines were used effectively for placing reinforced concrete canal lining on the Roza division of the Yakima Project.

This backfill will require compaction on both sides and invert. Data obtained to date on lining operations stress the desirability of obtaining high degrees of compaction in the subgrade prior to placing the lining as a prerequisite to satisfactory serviceability. And it is recognized that more efficient compaction of asphaltic concrete and earth material linings appreciably increases their life and effectiveness. Most present methods used for consolidating bottoms and side slopes of canal subgrades as well as the compaction of earth or asphalt lining materials are cumbersome and inefficient. The use of rollers actuated by cables, winches, tractors or trucks (see Fig. 1 and 2) represent only makeshift devices which are slow and costly to operate and do not always give the desired degree of compaction. In order for soil-cement and soil-bentonite mixtures to be economically feasible for lining canals, equipment capable of mixing, placing, compacting and finishing, preferably in one operation, is needed. It might even be possible to include trimming in the same operation so that all or part of the trimmed earth could be used in the mix without a second handling.

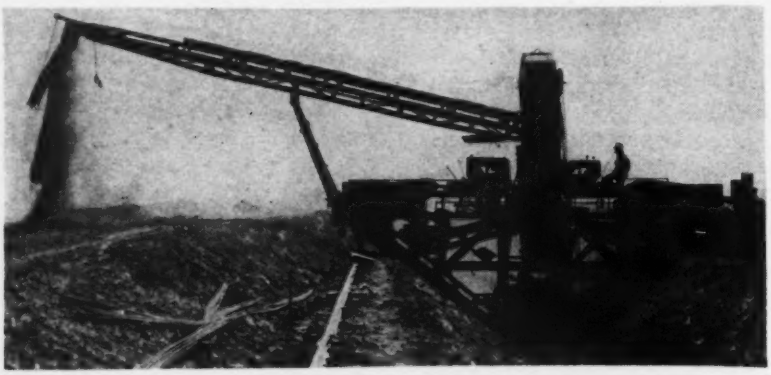
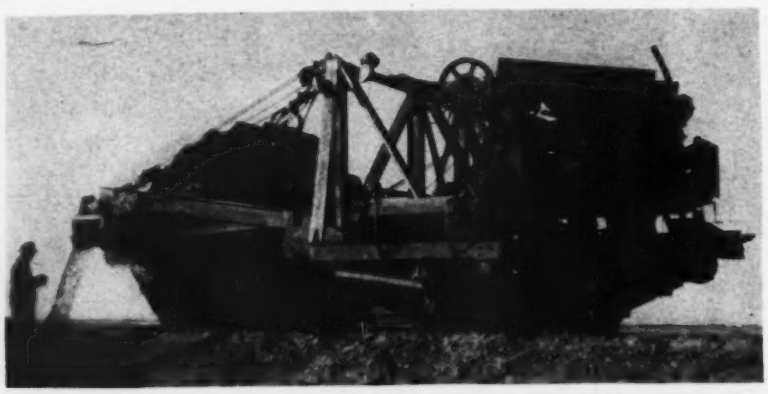


Fig. 4. Special canal trimming machines have been used successfully to cut sections to line and grade after rough excavation by power shovels.



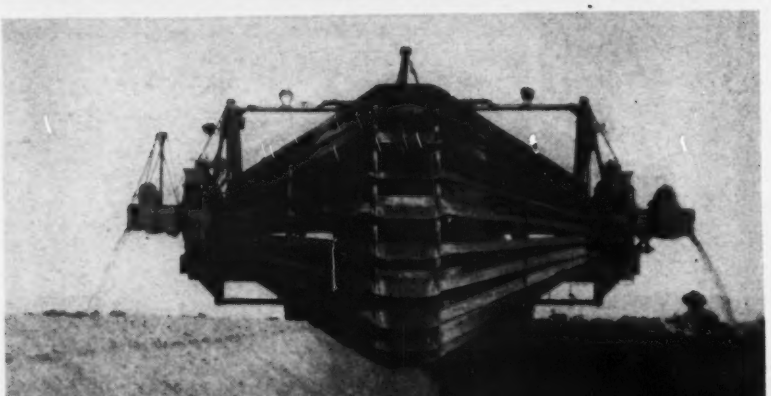


Fig. 5. Crawler-mounted trimming machine for excavating small canal is a recent development by the Macco Construction Co., Inc., for their work on Gila Project canals in Arizona.

Canal sections modified

In years past, the bureau has held rather consistently to the trapezoidal shaped canal section with its usual sharp angle at the intersection of side slopes and bottom. However, on some of the more recent lining installations, the design has been modified by rounding this intersection to a desirable radius, because such a shape better accommodates lining machines. Further changes in shape and design will be considered to encourage the use of new equipment showing reasonable promise. Bottoms may be round or rounded and the slope of the sides may be adjusted, within the limitations of local conditions.

Specifications will be written to allow wide latitude in the method of construction and types of equipment used, in order to promote improvements in construction procedures, and experimentation on the job will be encouraged officially. Some recent specifications have contained alternate schedules to obtain bids on two or three types of lining, and this practice will likely continue for selected installations with a view to promoting and obtaining the benefit from new construction methods that may be developed.

Concrete lining machines

More progress has been made in the development of mechanized equipment for placing portland cement concrete linings than for other types. This is due chiefly to the major volume of this type of lining constructed and the fact that canals so

lined have usually been large in sections, involving considerable concrete yardage.

Continuous lining machines, similar to those shown in Fig. 3, have satisfactorily placed many miles of concrete in Bureau of Reclamation canals and in the Colorado River Aqueduct of the Metropolitan Water District of Southern California. It is of interest that these machines, representing the latest developments in concrete canal lining equipment, are only improved models of a canal lining machine which was operated successfully on the Umatilla project of the Bureau of Reclamation in 1915 (*Engineering News*, Feb. 10, 1916, p. 264). The use of continuous lining machines, with efficient vibrator mechanisms, resulted in lower costs and more uniform and speedier constructed linings. Such equipment, however, may or may not be adaptable to many of the smaller laterals and ditches in need of lining. The expense of laying and removing the two rails along the berms, on which these machines depend for support and alignment, is too great for a small canal section, which involves much smaller quantities of concrete per linear foot of canal.

Caterpillar tracks can be used

With the possible elimination of reinforcing steel on many jobs, it may be practical to mount lining equipment on caterpillar tracks, which could move along on the bottom of the canal and be aligned by a taut wire or other means. Other modifications and improvements may be possible such that either portland cement or asphaltic concrete can be properly placed with the same equipment, involving relatively simple changes and adjustments of screeds and compacting mechanisms.

Two types of equipment for final trimming of the earth section are shown in Fig. 4 and 5. The latter, mounted on a crawler type tractor, is a recent development for use in small canals. These represent advancements in excavation methods, occasioned by the resourcefulness and ingenuity of progressive contractors, and indicate that similar improvements may be possible in lining and compacting machines.

The gunite equipment developed by the Macco Construction Co., consisting of mixer, gun, water tank, and compressor, is mounted on wheels for greater mobility. This equipment, now being used on the Gila Project in Arizona for placement of a 1½-in. gunite lining, follows the revolving excavator shown in Fig. 5 that was devised and assembled to excavate and line a relatively small canal. With it the contractor has avoided laying rails to carry machines, which is more or less conventional on large canal jobs. The excavator and trimmer is kept to grade and line by following a guide wire and adjusted in elevation by raising or lowering the blades. The mobile gunite apparatus lends itself very well to placing lining in a small section where a relatively small cubic yardage of material is required for each linear foot of canal.

Fig. 6. Emulsified asphalt seal for an experimental section of the Contra Costa Canal was applied by hand spraying because suitable mechanized spraying equipment was not available.

Hand spraying of bituminous sealing materials (Fig. 6) is extremely slow, high in cost, and results in considerable nonuniformity. Seal applications would be distributed better through pressure spray bars, accurately controlled for pressure, spray, and rate of travel, with a tank capacity adequate for covering an appreciable area of lining without refilling.

Precast concrete linings

The Bureau of Reclamation has done very little experimenting to date with precast blocks of portland cement concrete, but the U. S. Public Health Service has reported (*Public Health Reports*, Vol. 60, No. 21, May 25, 1945, p. 582) using them for lining drainage ditches and they appear to possess good possibilities for lining small canals. Casting blocks under mass production methods in a central plant avoids on-the-job mixing and placing operations that cannot easily be justified on a small canal. There remains, then, only the task of hauling the blocks to the canal bank, setting them in place, and sealing the joints.

Precast slabs considered

The Portland Cement Association is cooperating with the Bureau of Reclamation in fabricating two types of thin slab blocks for installation on an experimental stretch of canal. In this experiment standard equipment for manufacturing cinder building blocks will be tried. Obviously, to be more practical, machinery adapted to the special type of precast unit is needed; and if the precast slab idea shows promise, the bureau will expect the precast masonry unit trade to assist in expanding and developing this product.

A cold-applied mastic type of joint filler has been developed in the bureau's Denver Laboratory for use in "dummy" joints and shrinkage cracks in concrete canal linings. The use of this material for sealing the joints of precast concrete blocks has not been fully tested, but there is reason to believe that it will serve the purpose well.

A precast asphaltic concrete block has been laid as an experimental lining on a short length of canal in

Idaho. These blocks were built by rolling a one-inch thickness of hot-mix asphaltic concrete onto an asphalt saturated canvas backing, which overlaps the block on two sides. When laid in the field, this overlap is covered by adjacent blocks, forming a seal and bond. The joints are filled with asphalt to make the lining continuous. The cost of manufacturing and laying this type of lining by manual methods is necessarily high. It appears to have merit, however, if equipment can be developed to produce the blocks or slabs on a mass production basis and if laying and joint sealing methods are adequately improved.

Another somewhat radical idea that has been suggested, is the use of a prefabricated bituminous surfacing as used by the army during the war for hurriedly prepared advance air fields. This material consists of an asphalt impregnated burlap which was furnished in rolls like ordinary roofing felt. It has potential possibilities for lining small laterals and distribution ditches. If developed satisfactorily at a reasonable price, its successful use will depend on adequate machinery for unrolling the material, applying hot asphalt adhesive to the overlapping edges and placing it in the canal section.

Projects under construction

The prospective volume of canal lining work is indicated by the immediate need for water conservation, the thousands of miles of unlined canals in operation, and the many new canals and laterals planned for early construction. Some of the more urgent jobs are already contracted for or are under construction. Specifications for others are in progress. More than 20 miles of 3½-in. concrete lining and over 9 miles of gunite lining are now being placed, respectively, in the Coachella Canal in Southern California and in the Gila canals and laterals in Arizona. In the Central Valley of California, bids have been received and some contracts awarded for approximately 75 miles of 3-, 3½-, and 4-in. concrete linings on the Friant-Kern, Delta-Mendota, and Contra Costa canals. In the Columbia Basin, Washington, work will start soon on about 30 miles of concrete, gunite, and asphaltic concrete linings in the Main and West canals and Pasco laterals. These, and some shorter reaches of canal lining in Idaho, Texas, and other western states, are the beginning of a program designed to explore fully the possibilities and construction costs of the various types of linings and to provide opportunity for experimenting on a large scale with methods which may ultimately prove more economical and satisfactory than those accepted as best practice today.

In this experimenting the Bureau of Reclamation seeks the cooperation of contractors, equipment manufacturers and producers of construction material in reducing costs and developing better linings.

Alabama Has a 10-Year Program For County Road Construction

Considerable progress has been made by Alabama in its 10-year program of state aid in county road construction, which calls for expenditure of $30,150,000 over the first three years, provided advantage is taken of all funds available.

Under the direction of I. B. Rutledge, chief of the Bureau of County Aid, each of the 67 counties in the state can spend $225,000 as part of the federal aid program and a like amount under the state aid program during the 3-year period. Funds for the state aid are obtained from one cent of the state gasoline tax to be matched by the counties. In the federal aid program the state matches the federal amount during the first year and contributes one-half toward the federal grant during the second and third years.

To be eligible for the state aid, a county must employ a full time registered professional engineer and land surveyor, and must submit for approval a system of approximately 100 miles of the main roads of the county on which the money is to be spent. The program will be prosecuted on a "pay-as-you-go" basis. After the main roads are completed, the program will continue with tributary or feeder roads.

Roads constructed by the county may be either by county equipment and direct labor, or by contract. In either case, the county engineer will be in supervision of the work, subject to periodic check and inspection by the State Highway Department. Before any work starts the state and county enter into agreement setting forth the terms and details under which the work is carried on.

Payment of state aid is on a monthly or periodic basis with the county showing the total work accomplished and its cost, and making claim for reimbursement of fifty percent of the actual cost.

Mr. Rutledge pointed out that the federal-aid and state-aid programs for secondary roads are similar and can be carried on concurrently. The principal point of difference in actual operation, he stated, is that while state aid projects may be constructed either by direct labor and equipment, or by contract, all federal aid projects must be constructed by contract. In either case, the specifications of the State Highway Department will apply to all materials and workmanship.

The State Highway Department supervises the study of soils and investigation of base course materials and makes recommendations which the engineer includes in the plans and estimates for each separate project. In addition, any bridge structure which requires special design is handled by the bridge department, or if made by the county engineer, is subject to check and approval. Mr. Rutledge pointed out that the purpose of these provisions is to place at the disposal of the counties the methods of handling these items which have been evolved over a period of years.

Every possible assistance is given the counties in planning their road systems and carrying them to completion.

Puerto Rico's Planning Board in Action

***Contents in Brief**—A planning board with functions similar to that of a state planning commission in the United States has been operating for four years in Puerto Rico. Good progress has been made in the coordination of public improvement programs as well as in the encouragement of private enterprise developments although there were early fears that the board held too much governmental control. How the board operates and what it has accomplished is told in the following account by Engineering News-Record's correspondent in San Juan.*

PLANNING in Puerto Rico has received great impetus since the establishment of the Puerto Rico planning urbanizing and zoning board in 1942. The board is modelled after planning commissions in the United States, yet adapted to the peculiar economic conditions of the island. Its functions include those similar to state planning for the island as a whole, and those analogous to city planning for the urban areas of the island. The work already accomplished by the Puerto Rico organization is considered one of the most advanced in Latin America.

The planning board consists of three members apointed by the governor, with the advice and consent of the Puerto Rican Senate. A minimum annual appropriation of $100,000 is provided in the insular budget for expenses. Devoting themselves fulltime to the work of the board, the members receive an annual salary of $6,000, except the chairman who received $2,000 additional.

At present the board consists of the following: Rafael Picó, economic geographer, Santiago Iglesias, Jr., engineer and architect, and S. L. Descartes, economist.

Organization and duties

Seven divisions have been established in the organization of the board, with competent staffs to and in its work. These include: Office of the chief planner, engineering, urban development, insular industries and services, finance, office of the secretary and legal adviser, and administration.

Attached to the board, and forming an integral part of its work are three activities for which special appropriations have been voted by the legislature, namely: the urban land-use project, the official map project, and the map of territorial boundaries of the municipalities of Puerto Rico. The board contracts consultants with special skills to carry out master-plan studies and other technical work.

The Office of the Chief Planner assists the chairman in carrying out his executive responsibilities. Briefly, the chief planners duties are to direct and coordinate the technical work of the divisions, to advise on planning problems, and to handle many of the board's relations with other agencies of the insular government.

The Engineering Division is concerned with master plans and projects primarily of an engineering nature, such as insular roads, hydroelectric projects, water supply systems, sewers and airports.

The Insular Industries and Services Division deals with economic and social problems of island-wide nature, and with related programs such as health, rural resettlement, education, and development of new industrial possibilities in rural areas.

The Urban Development Divisions carries on master plan studies for urban areas including population distribution, land use, and public facilities such as highways, streets, schools, parks, public buildings and slum clearance. In addition, this division is in charge of zoning and subdivision regulations through which private development is guided within the framework of the master plans.

The Finance Division annually prepares the six-year financial program for the insular government. This includes the high-priority master plan recommendations of other divisions as well as other capital improvement projects proposed by government agencies.

The Office of the Secretary and Legal Adviser keeps the minutes of the meetings, is in charge of all official records, advises on legal matters, and represents the board in all court cases.

The Division of Administration handles the personnel, finances, services, pay rolls, and other "housekeeping" activities.

The powers and duties of the planning board can be summarized in the following groups of functions:

Master Plans—These are developed to serve as a guide for sound physi-

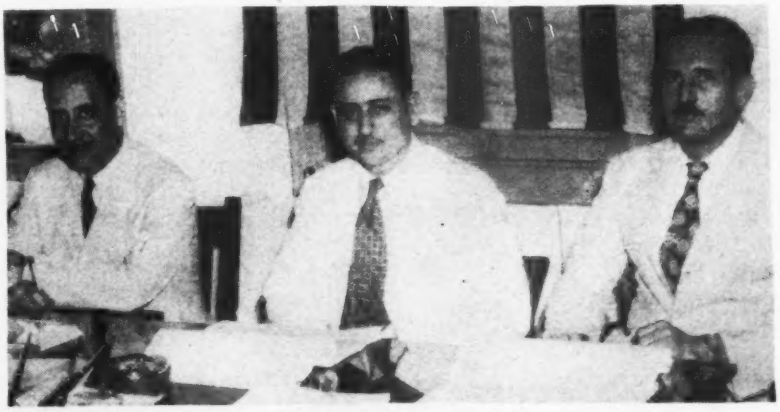


Fig. 1. Members of the Puerto Rico planning board: (l. to r.) Santiago Iglesias, Jr.; Rafael Pico and S. L. Descartes.

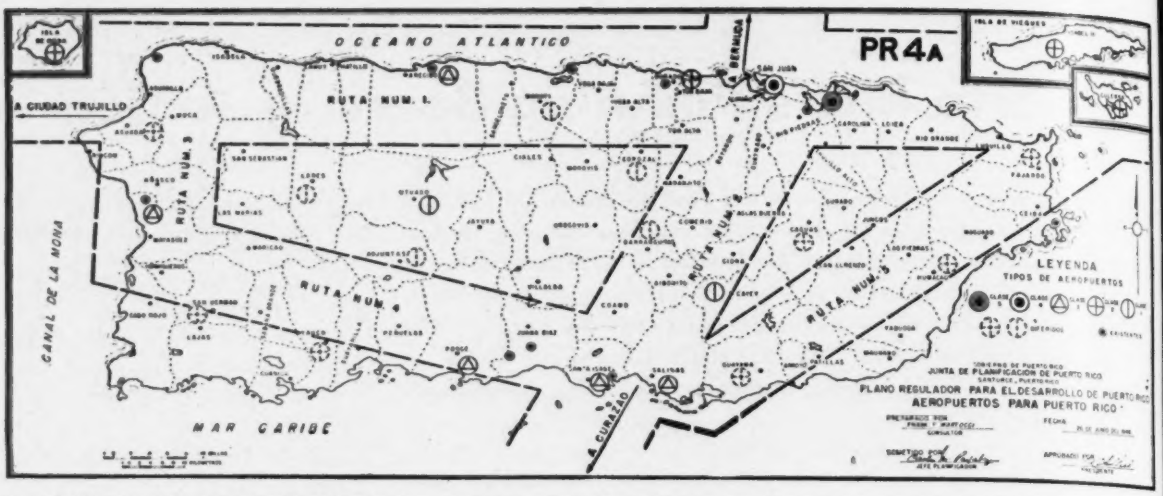


Fig. 2. Master plan for Puerto Rico's airport program calls for the construction and improvement of 25 landing fields. An international port near San Juan is expected to cost four million dollars.

cal and economic development of the island and its cities. They also provide criteria by which to judge the need and urgency of specific projects.

Six-year Financial Program—This is prepared annually and submitted to the executive and legislative branches of the insular government. It supplies information and guidance as to the most effective and appropriate means of executing those portions of the master plan that deal with public expenditures of funds.

Review of Public Improvements—In the light of the master plan and the financial program, the board reviews all public improvements and all governmental purchases of land proposed by the executive departments and agencies of the government and the municipalities.

Guiding Urban Development—Based on the master plan, the board seeks to promote efficient, harmonious and economic urban development, by means of land subdivision and zoning regulations, programs of slum clearance, improvement of traffic facilities, mapping of future streets and guidance of public improvements.

Social and Economic Studies—These are initiated as a basis for the formulation, coordination or review of plans for the development of the island's natural and human resources.

The Caribbean Office of the National Resources Planning Board, which was established in San Juan in September 1942, prepared a "Development Plan for Puerto Rico." This provided for present and future needs of the island, and estimated their costs. The Puerto Rico Planning Board has adopted partially this document, which was published as *Technical Paper No. 1* of the board.

As a result of four years of intensive studies and planning, the board has adopted the following final master plans: General district hospitals; major thoroughfares of the metropolitan area of San Juan; and island-wide plan of insular roads and airports.

The master plan for hospitals determines the location and recommended capacity of five new district facilities, as well as additions to three of the existing hospitals. A total of 3,400 new beds is provided in this building program.

Plans for road development

A coordinated and comprehensive plan for guiding road development in the metropolitan area of San Juan, capital of the island, over the next 20 years has been developed. Three types of thoroughfares are recommended; namely, express highways, avenues and main streets. Total length of the proposed system is approximately 138 kilometers.

Public highway and municipal roads development is guided by a master plan involving appropriations amounting to $154,429,000. This program, covering a 25-50 year period, includes the improvement to 2,305 km. of existing roads and construction of 2,626 km. of new roads.

The airport program envisions the construction and improvement of 25 landing fields spread throughout the island, including improvement to several army airports transferred to the insular government after the war, and the construction of a gigantic International Airport at Isla Verde, near San Juan, costing more than $4,000,000.

Appeals and court review

As an instrument of democratic planning, the board holds public hearings before the adoption of all regulations, official maps, the six-year financial program, and the master plans. Thus, all other government agencies and the public in general are kept continually informed regarding the activities of the board, and have ample opportunity to participate in the general programming work.

All regulations, after being adopted by the board and promulgated by the governor, are sent to the legislative assembly. If the lawmakers disapprove such regulations, they cannot be enforced as approved by the board, but if the legislature approves them they continue in effect as promulgated.

The planning act of Puerto Rico provides that any decision of the planning board regarding public improvements may be appealed within 20 days to the Executive Council (Governor's cabinet). The latter may amend, alter or revoke the board's decision. The Governor, on the other hand, may also amend any

part of the six-year financial program. The financial program then goes as a recommendation to the legislature, which in turn may revise the program.

In regard to the official maps showing the lines of new streets and street widenings, they must be adopted by the Executive Council of Puerto Rico, and may be modified by the legislature.

The Office of the Permit Official, recently created under the jurisdiction of the Insular Department of the Interior, is in charge of the enforcement of zoning regulations and official maps adopted by the planning board. The permit official, therefore, may refuse any construction permit application that is not in accordance with the official maps or zoning regulations. However, appeals may be taken from any decision of the permit official involving questions of law, and from this board appeal may be taken to the Supreme Court of Puerto Rico.

Looking to the future

Much criticism was expressed when the Puerto Rico Planning Board was established because of certain government controls given to the board. But it has served, nevertheless, a very useful purpose to coordinate the large public improvement program that has taken place in the island during the past four years. And as an instrument of postwar planning it has given Puerto Rican businessmen and industrialists some knowledge of what to expect from the government, thus encouraging planning on the part of private enterprise.

The board also has served a very helpful purpose in stimulating better urban developments. Last year, for example, it secured passage of legislation appropriating $7,000 to be used during the next five years for the awarding of an annual prize of $1,500 to the best housing development constructed each year.

Industrialization a necessity

It is generally conceded that Puerto Rico must industrialize. This can only be accomplished through a well-planned program to stimulate new enterprises and to improve the efficiency of the present industrial set-up in the island. At the same time efforts must be made toward a diversified agricultural economy, if present inadequate standards of living are to be improved. Population is increasing at the rate of 55,000 persons a year so that by 1960 there will be about 3,000,000 inhabitants to be fed in this little island with only 3,500 square miles, half of which are arable. Therefore, planning would seem to be more necessary in Puerto Rico than in any other spot in America.

The policy of the present administration in Puerto Rico is this: Increase production and secure better distribution of the fruits of production. To carry out this policy the

Fig. 3. Subdivision construction near Rio Piedras, not far from San Juan. Urban development projects must meet standards established by the planning board.

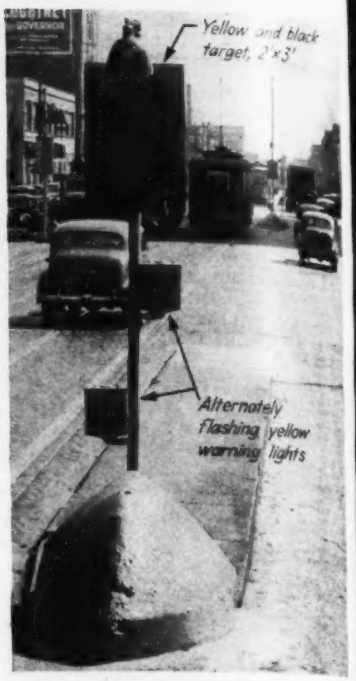
Photo by Miguel Angel Studios

Fig. 4. Development of natural resources is one of the objectives of the planning board's program. It is hoped that there will be greater industrialization of the type represented by this plant of the Puerto Rico Cement Co., financed with government aid.

government has established an Industrial Development Co. which is empowered to start new industries on its own initiative, and to assist private industrial enterprises through providing information and research. A development bank lends government funds either to private enterprise for new industries or expansion of existing plants or to the Industrial Development Co. for its own projects.

An Agricultural Development Co. also has been established to experiment with new products and to carry out large-scale commercial operations with agricultural products. A land authority is charged with the enforcement of the land-reform program by breaking up the large holdings and establishing proportional - benefit farms projects in which both management and labor share in the profits of sugar-cane plantations.

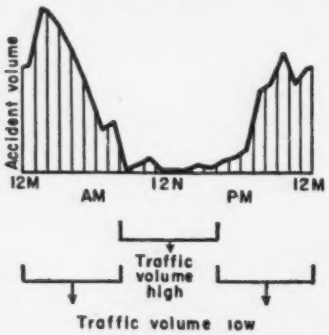
Major difficulty in expanding the public improvement program in Puerto Rico is the acquisition of building materials and equipment both of which are in great demand and under government control in the United States, the only source of supply. The insular government has sought to learn to what extent it may look to the United States for assistance in its efforts to improve local conditions and to carry out its industrialization program.



New street-car safety loading zone being installed in Chicago as the result of field trial installations of more than 15 suggested models.

Chicago Begins Installation Of Model Safety Islands

SIX YEARS' STUDY of traffic accidents at existing street-car safety islands and one year's experimentation with some 15 field trial installations of suggested improvements by engineers of Chicago's Department of Streets and Electricity have resulted in production of a design illustrated by the accompanying photograph. The city plans to install 1,500 of its new safety islands at loading zones as rapidly as funds and materials become available. Delays on deliveries of the first order for 300, placed several months ago, has set back the replacement program. Up to Nov. 25, the Department of Streets and Electricity, had built 26 of the new units and installed underground facilities for many more.



Study of street-car safety zone accidents in ten-year period from 1935 to 1945 shows that greatest number of motor vehicle collisions take place during hours after midnight, when traffic volume is lowest.

Studies over a six-year period disclosed that 4,477 motor vehicles had struck the end abutments of Chicago's street car safety zones in that time. Of these accidents, 570 occurred in daylight and 3,907 during hours of darkness. The figures revealed that 87 percent of these collisions took place during non-daylight hours, when only 25 percent of the total traffic was in motion. In fact, 22 percent of the accidents occurred between 1 a.m. and 3 a.m., when only 1.6 percent of all traffic was on the streets.

With the encouragement of Lloyd M. Johnson, commissioner, and Leslie J. Sorenson, city traffic engineer, the traffic engineering staff whipped dozens of suggested improvements into shape for practical tests during more than a year. After making some 15 field trial installations and observing these installations day and night, the engineers selected the best ideas and consolidated them into the present standard safety loading zone.

As described by Ralph F. Michel, traffic signal engineer, the base of the model installation is a substantial concrete prow, designed to resist any kind of impact which it may receive. To the back of this prow is affixed by hinged connection a tubular standard, set at an angle to give or buckle, rather than shear off, should excessive force be applied.

Electrical warning lights attached to the standard are operated by an astronomical time-switch, adjusted to burn the warning lights 30 min. before the street lights are turned on and 30 min. after the street lights are extinguished. The brightest, after-dark warning devices are two high-intensity, yellow, alternately flashing lights. These lights are arranged, one high and one low, to produce a diagonal wigwag effect. Intensity of the flashing beacons is sufficient to permit them to mellow to perfect warning signals when the lenses have received their first coat of traffic film. Even mud, track groove splash and other dirt do not obliterate the lights.

Above the flashing beacons is a 2x3-ft. target, diagonally striped in yellow and black and illuminated by a steady, burning light. Tests have demonstrated that the entire arrangement has excellent attention and alerting value. It can be seen either near or far by an approaching motorist even though he be surrounded by competing traffic.

Total cost of the 1,500 proposed installations is estimated at $800,000. Replacements probably will be made at a rate of $100,000 to $150,000 per year.

Transporting Concrete in Dump-Trucks

J. A. Nicholson
Toledo, Ohio

***Contents in Brief**—Successful experience has demonstrated the feasibility of delivering pre-mixed air-entrained concrete over distances up to 15 miles in modified or specially designed dump trucks. Principal requirements are watertightness and fast discharge. The development offers possibilities for reduction in costs of concrete delivery and of handling on the job.*

EXPERIENCES of the last few years have convinced many producers and users of concrete that costs can be substantially reduced and handling can be greatly facilitated by pre-mixing air-entrained concrete in a central plant and hauling it in a modified form of dump truck, equipped with proper discharge and chutting devices. The writer's own experience is only one example of a number which could be cited.

One commercial ready-mix plant in particular probably deserves first credit for successfully pioneering truck delivery of pre-mixed concrete. Long before the common use of air-entraining cement, Kuert Concrete, Inc., South Bend, Ind., had demonstrated that properly controlled concrete made with standard portland cement could be delivered in water tight dump bodies. The company's entire production was hauled that way. Now it standardizes on air-entrained concrete, and in 1946 processed and hauled more than 60,000 cu. yd.

Fig. 1. For foundation mat, special dump truck delivers concrete through broad chute to areas within reach of bank. This procedure allows opening full tailgate of dump body to discharge 3-yd. load rapidly.

Central mixing with dump-truck delivery was also used recently on a large airport in California. Loads of 9 cu. yd. each were hauled in dump trailers, enabling the contractor to meet successfully a schedule of 250 cu. yd. per hour. In no other manner could such a large volume of concrete be handled so economically. And as a further advantage, the trucking equipment served also for other hauling purposes.

One plant's experience

Experience of the writer's Toledo plant illustrates the possibilities of pre-mixing and truck-hauling concrete. All concrete is made with air-entraining cement (from one mill), slag and lake sand. This plant processed about 75,000 cu. yd. of concrete in 1946. Dump trucks delivered specification concrete distances up to 15 miles from the plant. At present the plant is furnishing all of the concrete for a new 2,000,000-bu. elevator of the National Biscuit Co. To this project the open-body trucks are hauling 6 in. slump concrete (cement content, 6 bags per cu. yd.) a distance of 4 miles. The elevator walls are 118 ft. high and only 8 in. thick. For such slip-form work, quality concrete is essential.

During the month of August, 1946, we processed more than 11,000 cu. yd. of concrete. In our own specially built dump trucks, we delivered about 8,500 cu. yd., and more than 2,000 cu. yd. was picked up by customers in their own trucks.

Prior to midsummer 1944, our Toledo operation was all mixed in transit. During each of the preceding years, 1942 and 1943, the plant delivered, with 14 truck mixers, about 70,000 cu. yd. of concrete. During 1943, however, we became convinced that, in air-entraining cement, the concrete industry had forged its greatest weapons since the inception of cement. At the same time, we found that air-entrained concrete, once

mixed, stays mixed. A number of tests definitely proved that air-entrained concrete could be processed at a central mixing plant and delivered, free from segregation, in ordinary dump trucks. The problem developed into a search for a dump truck that could satisfactorily haul, discharge, and place concrete.

Mixing plant

In processing our concrete we use two types of mixers, a 3-yd. tilting mixer and a 1½-yd. non-tilting unit. Our preference for the tilting-type mixer is based on two facts: First, the tilting type discharges much faster; and, second, the discharge operation of a non-tilting mixer tends to produce some segregation.

Our storage bins, screw conveyors, and weigh hoppers are of conventional design and construction. Any successful central mixing plant must be adequately equipped to produce engineer-controlled concrete. Uniformity in slump, strength and yield must be achieved. In our plant, we lease facilities for weighing and moisture control of aggregates. The plant superintendent, Kenneth L. Drew, is a trained concrete specialist. Prior to coming with us, he had nine years' experience in concrete testing work with a Toledo testing laboratory.

Concrete ingredients

Use of proper aggregates and cement completes the requirements of a successful central mix operation. The sand is of special importance; it must contain adequate fines to produce sufficient air entrainment (4 to 6 percent) for concrete to be hauled without segregation. We use cement in which the proper amount of air-entraining agent has already been ground at the mill. Others may prefer to buy regular portland cement and introduce the air-entraining agent at the mixer. To achieve best results a central-mix operator should select the air-entraining cement which produces the most uniform concrete. He should then standardize on cement from that plant even though his wife's brother works for another cement company.

Central mixing is simple. The rewards of simplicity are lower-cost operation and uniform concrete. We refuse all orders that require high-early-strength cement. For high-early-strength concrete we introduce calcium chloride at the mixer. We turn down all business that specifies either different aggregates from those we use, or another brand of cement.

Hauling equipment

In hauling concrete we employ two specially designed, watertight bodies. Both units already do a good job of concrete hauling, but many improvements are in the making, special attention being given to spring construction of the chassis, shape of the body, use of baffle boards, and discharge equipment.

One type of concrete dump body (Figs. 1 and 3) has been used by us since 1944. This unit will discharge a 3-cu. yd. load in less than 30 sec. on jobs that do not require chuting. A newer type (Fig. 2), added to our fleet in June, 1946, provides high discharge and ability to chute concrete equal to a high-discharge truck mixer. Other manufacturers are planning to enter the field and now either have their plans on the boards or are trying out experimental units. Some present manufacturers of truck mixers are seriously studying the development of truck-hauled concrete to determine the advisability of making their own non-agitating delivery units.

Many of our customers already have adapted trucks for hauling concrete. They believe that delivering their own concrete gives them better control of their jobs; also, the truck is available for other hauling that may be required. Moreover, with the lighter, more maneuverable dump truck the contractor will be able to eliminate much of the wheeling or buggying formerly necessary when concrete was received from heavier and less maneuverable units for mixing in transit. Because the dump truck

Fig. 2. High discharge is feature of concrete dump body which can chute 4 cu. yd. into forms in 90 sec. Baffle board in 4-yd. model aids delivery of uniform concrete. Body is self-cleaning.

can deliver concrete with less damage to the subgrade, lower costs should be attained on ground slab construction.

For the contractor, three contributing factors will help to lower placing and finishing costs: (1) Air-entrained concrete permits easier, faster placing and finishing; (2) controlled processing at a central mixing plant produces more uniform concrete, further reducing placing and finishing costs; and (3) with the same number of delivery units, as much as 20 to 30 percent more concrete can be delivered daily. The same concrete crew should place and finish many more yards of concrete, at a lower unit cost.

Outlook for ready-mix plants

Economic advantages offered in cheap delivery of air-entrained concrete are so fundamental that present ready-mixed concrete operators are definitely at the crossroads. Those now in the business will either promptly take advantage of the many opportunities offered in central mixing and dump-truck deliveries or will face competition from new firms and individuals, not now in the business, who have the ability to recognize the opportunity. A firm now supplying only concrete mixed in transit, to be successful, must now add facilities to make central mixing and dump-truck delivery optional.

Fig. 2. Clamshell gate discharges through short chute into bucket for crane-handling of concrete to areas beyond reach of delivery equipment.

New commercial plant competition may come from slag producers, sand and gravel operators, trucking companies, and large coal retailers. Processors of slag know that air entrainment has eliminated the problem of harshness—the chief objection to the use of slag as a concrete aggregate. Also, some authorities believe that slag concrete is the easiest air-entrained mix to haul in non-agitating equipment.

A number of sand and gravel operators have already gone into central mixing. In such plants, concrete trucks can be used also for hauling aggregate. Truckers shied away from the one-purpose truck mixer but offer potential competition in central mixing. The coal dealer has been looking for a good off-season sideline. Both current types of concrete bodies make excellent coal-hauling trucks.

A number of years ago the building supply dealer who did not have the nerve or capital to get into mixed-in-transit operations saw a major profitable part of his business disappear. Today, in one large market, several dealers are going together into central mixing; they plan to operate fifty non-agitating trucks.

Possibilities offered by plant pick-up sales are readily apparent to the commercial operator. Including these pick-up sales, our own experience indicates that 40 percent more yardage can be handled daily by central mixing and dump-truck delivery than by delivering transit mix with an equal number of truck mixers.

Disaster Councils Prepare To Cope with Emergencies

City councilmen and thousands of volunteers with wartime training are joining ranks in San Francisco to form a disaster corps equipped to cope with earthquakes, fires and other emergencies, according to the American Municipal Association. The corps, directed by a disaster council similar to those created or proposed in other cities, will be a permanent fixture of the San Francisco government.

The proposed disaster plan provides for dismantling the elaborate wartime civilian defense setup and regrouping the personnel under nine divisions including fire, police, medical, communications, public works, Red Cross and utilities. An executive officer appointed by the mayor will be the administrative head of the new unit.

Operations of the disaster corps in the field will be directed by mobile two-way radio. At a moment's notice, firemen, demolition squads, medical workers and canteen workers may be rushed to any area in or near San Francisco where emergency aid is needed.

The San Francisco plan

The California Disaster Act under which the San Fransicso council is being formed provides that one law enforcement agency may give assistance to another in emergencies regardless of jurisdiction. Such services constitute a legal charge against the state when approved by the governor. The act also provides that disaster corpsmen injured in line of duty will be covered by workmen's compensation insurance the same as regular public servants.

Other California cities with well-established disaster councils include Berkeley and Los Angeles. In New England, the Hartford, Conn., Disaster Emergency Council is a typical disaster plan providing for emergency organization of regular city departments under the mayor plus mobilization of civilian assistance under the American Red Cross.

Arkansas furnishes an example of state action to cope with flood disasters which frequently occur in that section of the country. In that state the plan is administered by heads of state departments and the Red Cross and divides the state into natural refugee concentration zones into which relief is directed in time of emergency by teams of field workers.

Traveling Scaffold 145 Ft. High Used In Repairing Timber Airship Hangars

***Contents in Brief**—Repairing arched timber trusses that support the roofs of the Navy's large "blimp docks" is facilitated by a scaffold mounted on house-mover trucks built by the contractor doing the work on West Coast docks. The scaffold, on which 50 men work and which moves ahead 60 ft. per shift, is 145 ft. high and has no timbers larger than 6x6 in.*

A PROJECT for effecting repairs to six of the Navy's huge timber blimp docks on the West Coast has involved the use of an unusual type of falsework or moving scaffold to provide access for the workmen and means of delivering material to the arched trusses supporting the roof, which reach a height of 157 ft. at the center of the building.

Because of the height and difficulty of access to the arch ribs to be repaired, first attention was given to designing a scaffold that could be slung from the monorail built into the dock at the time of construction, or by otherwise supporting the necessary scaffolding from the arch ribs themselves. However, after the relative desirability of three suspended or floor-supported scaffolds had been carefully weighed the contractor decided the most satisfactory type would be a traveling timber structure one-half the width of the dock itself, with working platforms at the required levels on one side of the scaffold only. A factor in this decision was that it would give minimum interference with Navy use of the floor area. The base would be 60 ft. square, and 6x6-ft. towers at each of the four corners would be supported on solid rubber-tired trucks or dollies, each designed for carrying a 40-ton load in house moving service.

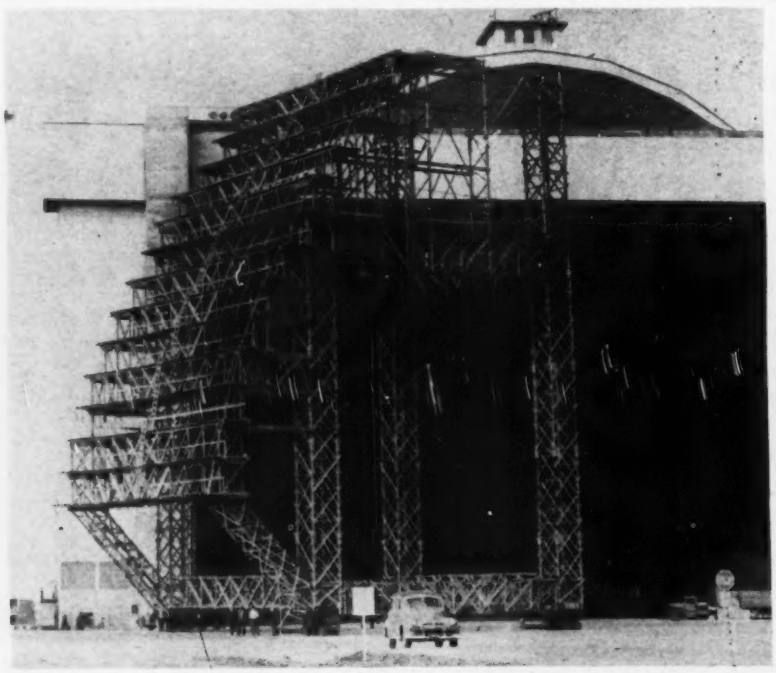


Fig. 1. Huge traveling scaffold, 145 ft. high, being moved into a hangar at Moffett Field in California to effect repairs to the timber framing of the structure.

The scaffold as a whole is designed for a live load of 600 lb. concentrated at any point on each of the sixteen working platforms, plus a 10-lb. wind load. Ring connectors were used at important connections. The supporting dollies are heavily built and, including their structural steel platforms, weigh 6,600 lb. each.

Twelve wheels carry scaffold

Each dolly has two axles with three solid rubber-tired wheels 20 in. in diameter on each end, a total of twelve wheels. The truck frame connecting the two axles is surmounted in the center by a pair of heavy plates connected only by a king pin. This makes it possible, when the upper portion of the truck is supported on jacks, to rotate the lower portion about this king pin and thus to place the wheels at any desired angle. Similarly each axle can be separately aligned with respect to the truck itself by means of a pair of circular disks at the center of each axle. These two disks have, near the outer circumference, 2-in. holes on 3-in. spacing, thus making it possible, by use of relatively small diameter bolts, to fasten the plates together in any desired position.

The king pin centered on each truck is threaded and has a nut on the lower end as a protection against uplift that might be caused by wind or seismic forces. This item is of importance because the trucks thus add their total weight to resist overturning moment. Also this raises the wheels when the trucks are jacked up, facilitating the separate positioning of each axle.

Fig. 2 illustrates the method by which the sixteen working platforms are supported at the desired levels. These platforms, located not more than 8 ft. apart vertically, give workmen a feeling of security and thus greatly increase efficiency as compared to working at considerable heights with nothing below. The only portion of the arched trusses not ac-

cessible from these platforms is that immediately above a steel wire safety net. This part of the work can be reached from the catwalk which runs longitudinally through the dock.

Framing the scaffold was rapidly accomplished. The timber went into place rapidly, once it was delivered to the working platforms, because nail holes had been drilled in advance. Nails were started in the holes by hand, and driving was completed by a follow-up worker using a pneumatic hammer. One check on the work showed that the pneumatic hammer operator drove 6,000 twelve-penny nails in a 9-hr. shift.

After completing the work at Moffett Field the program is to dismantle this traveling scaffold and ship it by truck to the air station in southern California where a similar strengthening program on the next two blimp docks will be carried out. With that in mind the struts and columns, made up as rectangular box trusses, were put together with bolts at joints where the members would be taken apart for shipment. That is, bracing in two of the four planes in each tower were nailed; in the other two planes bolts were used. With this construction, when it is desired to disassemble the scaffold for shipment, the removal of bolts will permit taking the structure apart into flat, 18-ft. sections to be trucked 500-miles to the next job.

Wire rope guys

Wire rope guys in ½- and ¾-in. sizes were used as stays, for wind bracing and for general stiffening of the scaffold. That portion of the structure on which the eight lower working platforms are carried is supported from below by an inclined strut and from above by a ¾-in. wire rope, as shown in the drawing. Similarly the cantilevered portion at the top of the scaffold relies upon ¾-in. tie-backs and hold-down to forestall any danger of rotation about the line along the base of the overhang.

In the central portion of the scaffold where there are high open panels, crossed diagonals of ½-in. wire rope have spans exceeding 85 ft. and are of material aid in giving rigidity. Crossed diagonals are also used in the inclined panels and in horizontal planes at the level of the supporting trucks. They are used again in the plane of the horizontal truss that is 80 ft. above floor level.

All these wire ropes are tightened with great care in recognition of the fact that it would be easy to distort and overstress members in any of these panels by putting too much tension in the cables. The practical rule adopted is that in the 85-ft. spans, the sag at midpoint is not to be less than about 3 in. measured vertically at the center of the span. Similarly, for the lesser spans, an approximate limiting figure has been

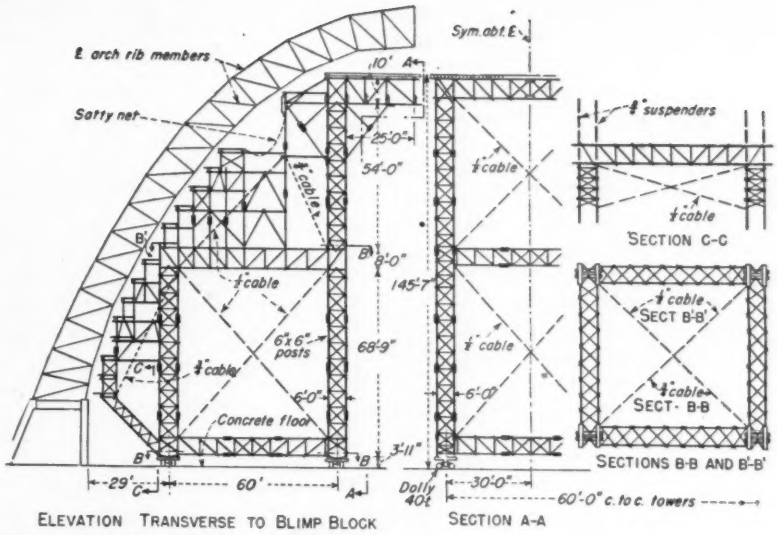


Fig. 2. Principal dimensions and details of the traveling scaffold, in plan and elevation. Note how the two overhanging portions are supported by an inclined strut supplemented by cable guys.

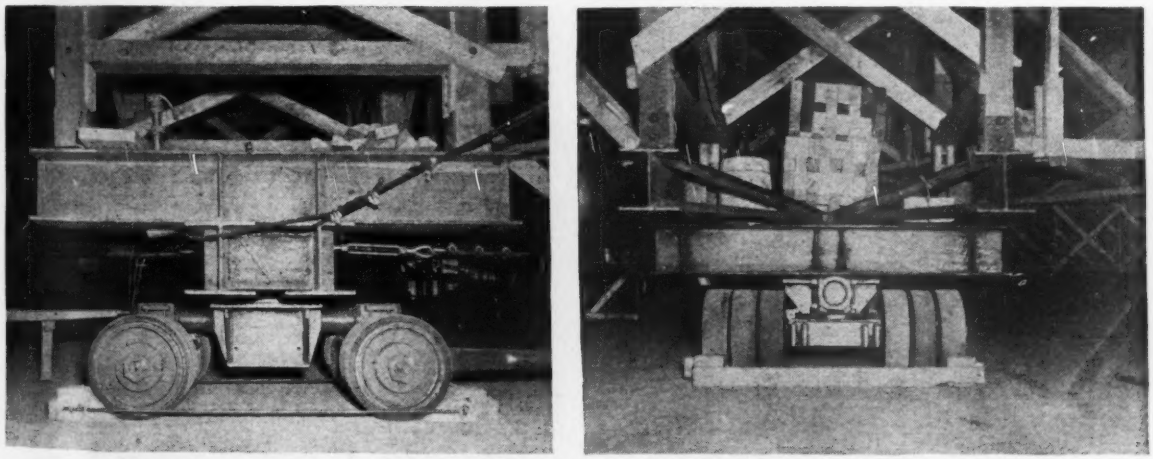


Fig. 3. Special twelve-wheel trucks at each corner of the scaffold permit it to be moved and turned with ease. A king pin at the center of the chassis permits each truck to be turned at right angles to the normal direction of travel, while adjustable disks at the ends of the chassis permit each axle to be fixed at any one of several angles.

set by the designer for each span. The objective was to put a pull of about 1,000 lb. in each wire rope, thus giving reasonable rigidity without too much induced stress in structural members.

Turning the scaffold

Hoisting of material to the various working platforms as well as moving the entire traveler forward is accomplished by a 40-hp. gasoline hoist. Materials are raised in skips with the aid of a snatch block that can be fastened to the bottom chord of the arch ribs at any point convenient for landing the materials on the successive stage levels. For advancing the scaffold a 1-in. line from the hoist is reeved through four part blocks, and the 60-ft. forward move is made in about 3 min. These rapid moves and, in fact, the design of the traveling scaffold as a whole, are made possible by the fact that all operations are on the concrete paved floor of the blimp dock itself.

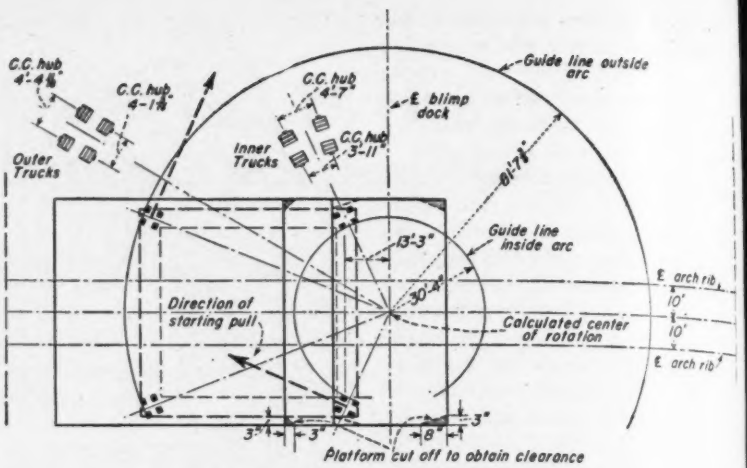


Fig. 4. Close calculation and the trucks with adjustable axles made it possible to turn the rig 180 deg. in a few hours, so that it could work on the opposite side of the hangar. Arcs of two circles were painted on the floor as guides.

This was also a factor in turning the scaffold quickly after it had completed the 1,000-ft. run along one side of the dock and was ready to return up the other side. For this move it was unnecessary to remove any essential part of the scaffold structure, only a small triangle at each corner of the overhangs had to come off. Calculations were made of successive positions in rotation that would clear the bottom chord of the arched trusses. It was found that a center of rotation could be located that would permit moving the structure in the arc of a circle from a position slightly offset from where it finished work on one side to a corresponding position on the opposite side of the dock. This center of rotation was outside the square inclosed by the framing connecting the four trucks of the scaffold, and was 43 ft. from the center of that square.

To reach a position suitable for starting rotation on the circular arc, it was necessary to move the scaffold back from the roof trusses a distance of about 15 ft. Before making this move the corners of the scaffold were jacked up and the wheels were all set at right angles to their working position. On completion of this move the corners were again jacked up and each of the eight axles was set in a position radial to the center of rotation selected for the move. Two circular arcs were painted on the concrete to mark the line of travel along which the trucks should move in the turning process. The outermost edge of the tires on the two

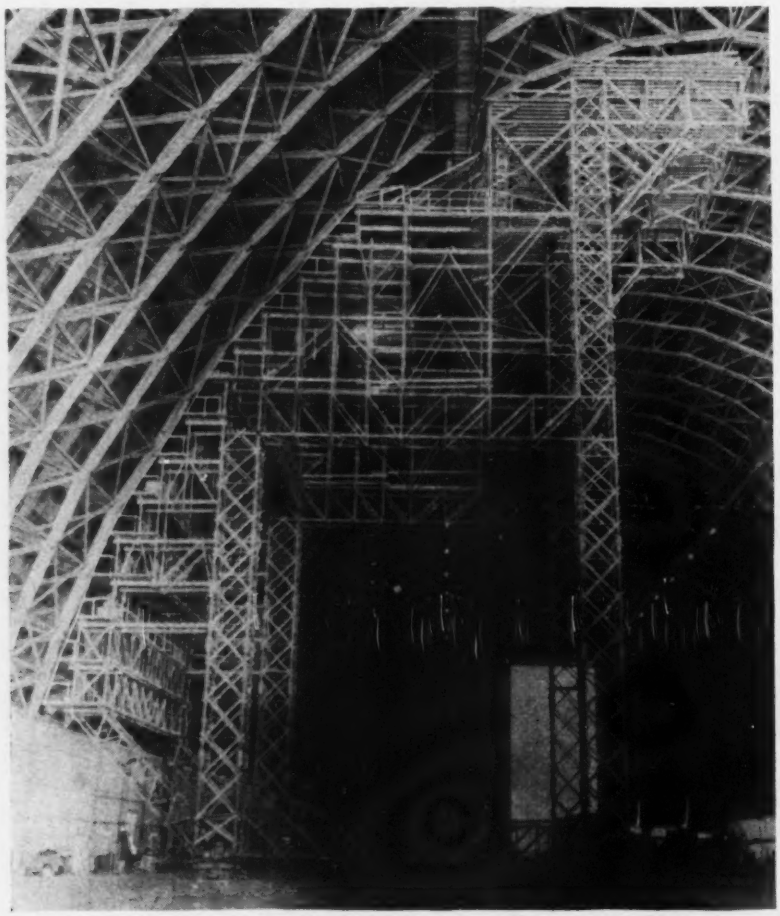


Fig. 5. In place in the hangar, the scaffolding occupies only half of the floor width, leaving much of the total area available for use.

trucks farthest from the center of rotation followed the larger arc, the inner trucks the smaller arc.

Two diagonally opposite trucks were selected for attaching the 1-in. wire rope used in the pull, and these lines were reeved through snatch blocks set where the starting pull would be tangential to the arc along which the structure was to move.

In all, four changes in positions of the axles were necessary to accomplish the move from working position on one side of the dock to corresponding position in the opposite side. These changes and all operations included in the turning of the scaffold in the first of the two docks at Moffett Field were completed, using only part of the normal working crew, in 4 hr.

It is interesting to note that the turn around in the second hangar was completed in about 2 hr. instead of 4. Actual time for swinging the scaffold through 180 deg. was 40 min.; the remainder of the moving time was used for the shifting, normal to the dock center line, before and after the turn. The entire transfer from one working position to the other required four successive jacking operations in lifting the corners of the scaffold to permit the supporting trucks to be turned to the new direction of travel or, in the case of the turn itself, to permit the axles to be radially aligned.

An item worthy of note in the technique developed in moving is the use of some convenient weight to serve as a plumb bob at each of the four corners. In straight-ahead moves these four suspended markers were watched carefully and were used as guides as they were made to follow straight lines on the floor, avoiding danger of any tendency of columns to spread or separate at the bottom.

Application of this idea was made easy by the construction joints in the concrete pavement that run parallel to the side walls. The plumb bobs were suspended above these joints when the scaffold was to be moved along the wall. During the move one man was assigned to each of the four plumb bobs while another man operated the tongue on each of the four trucks. The man stationed at each plumb bob gave signals, as necessary, to the man guiding the tongue on the nearby truck. The tongues were effective in obtaining a nicety of control.

At the outset the scaffold was set in a position such that working platforms cleared the arch ribs by only about 18 in. Later the men found it desirable to have more space for freedom of motion and the rig was moved back to give a clearance of about 3 ft. To avoid interference from falling objects, the men assigned to the 16 working platforms were divided into two crews which worked toward each other, that is, one started at the top and worked down while the other started at the bottom and worked up.

For each position of the scaffold, work is done in three of the 20-ft. spaces between arch ribs for the full height from haunch to crown, 145 ft. above the floor. In the third quarter of the Moffett Field contract this 60-ft. length of the work was being completed in 5¾ hr. as compared to a full day's time when the job started. This was with the same crew, a total of 63 men, of which 58 worked on or around the scaffold.

The general scheme of the scaffold design was worked out by the contractor's engineer, George G. Clark, in conjunction with Woodruff & Sampson, consulting engineers, San Francisco. The contract is under the general supervision of R. N. Pomeroy, vice-president of J. H. Pomeroy & Co., Inc. J. R. MacDonald is project manager and Harold Littlefield superintendent for the contractor.

The work is being done for the Bureau of Yards & Docks, U. S. Navy. Comdr. J. S. Marsh, CEC, USN, is resident officer on construction at Moffet Field. Capt. K. K. Bragg, CEC, USN is officer in charge of work on the six West Coast docks. All of the work is under the jurisdiction of the Pacific Division, Bureau of Yards & Docks, of which Rear Adm. Henry F. Bruns, CEC, USN, was director until his death Jan. 20.

New Data on Douglas Fir Beams In Department of Commerce Report

New information on the strength of Douglas fir balk (beams) in bending and compression, both dry and wet, is contained in a report now for sale by the Office of Technical Services, Department of Commerce.

Balk, 6 x 8 in. by 9 ft. 2 in. long, were tested full size by loads applied at the third points. The average of 12 such specimens gave an ultimate strength of 8,500 psi. with a modulus of elasticity of 1,900,000 psi. computed from the midpoint deflection and of 2,159,000 computed from the top fiber strain. Midpoint loading tests were also made on 2 x 2-in. sticks, 32 in. long, cut from the large balk. In these tests the average ultimate strength was 10,520 psi. and the average modulus of elasticity was 1,706,000. Compression specimens, 2 x 2 in. by 8 in. long, cut from the same sticks, had an average ultimate strength of 6,030 psi. and a modulus of elasticity of 1,925,000.

Moisture decreased the strength of the specimens. In tests of the 2 x 2-in. sticks the effect of a 24-hour soaking was to decrease the ultimate strength from 10,520 psi. to 9,220 psi. and to bring the modulus of elasticity down from 1,706,000 to 1,421,000. In tests of the compression specimen, soaking decreased the ultimate strength from 6,030 to 3,650 psi. and the modulus of elasticity from 1,925,000 to 1,860,000. The average gain in moisture was about 9 percent by weight.

Annual growth rings per inch did not seem to be related in any way to strength and stiffness. However, specimens loaded with the growth rings vertically had slightly higher moduli of elasticity and slightly lower ultimate strengths than specimen with growth rings running horizontally. The tests reported were made for the Army Engineer Board, Fort Belvoir, Va., in an effort to determine what could be expected of Douglas fir balk used in pontoon bridges. The work was done by Profs. L. P. Mains and L. A. Brothers, Drexel Institute of Technology, Philadelphia, Pa., under the direction of H. L. Bowman, consultant for the National Defense Research Committee.

Highway Traffic Striping

● In the past few years the painting of traffic control stripes on pavements has progressed from the push-cart stage to that of relatively high speed, mechanized big business, with states spending hundreds of thousands of dollars per year to show motorists the safe path to follow. Most of the machines used are "home-made" in highway maintenance shops starting with assembly of available standard parts, such as portable compressors, spray guns and an old automobile chassis. But from this point all similarity to standard equipment vanishes. As an example ingenious ideas have been developed for mechanically starting and stopping the paint spray to exactly duplicate existing, variable-length dash lines. Details are presented here on equipment used in New York, Virginia, and Missouri. An earlier article, *ENR* Dec. 28, 1944 vol. P 842 describes developments made recently in Ohio.

Dash Line Road Striping Made Easy

Charles R. Waters

District 5 Engineer (Buffalo, N. Y.)
New York State Department of Public Works

CONTROLS for paint spraying have recently been developed by the State Public Works Department in western New York to mark traffic lines on pavements, so that the length of dash lines may be varied and so that the paint may be started at any place to duplicate dash lines previously placed on pavements. Without such apparatus the placing of dash lines becomes haphazard, and sometimes make a solid line out of what is supposed to be a dash line.

The broken marking is made automatic by a cam arrangement that mechanically opens and closed the paint guns at regular intervals. The length can be adjusted to agree with previous markings, by means of a variable drive through a "fifth" wheel that runs on the pavement. Some features of the arrangement are shown in Fig. 2.

A revolving pointer in clear view of the valve operator at all times shows the position of the painting cycle and a change can be made in the starting point by simply turning a handle. The drive consists of a V-belt running on a split pulley, and operates through a speed reducer that varies the speed of revolution of the cams, a well known principle in variable speed transmission. Another variable speed transmission in use, which is equally efficient, consists of a small leather-tired wheel running on a movable shaft at right angles to a revolving disc.

Fig. 1. Pushmobile developed in New York for painting or duplicating one to three solid or dash lines on pavement.

• Standard pavement marking

Several years ago New York adopted a standard method of marking pavements, which conforms to the War Emergency Edition of the Manual on Uniform Traffic Control Devices for Streets and Highways. It is essentially a dash-line system with a solid line parallel to the dash line in areas where other cars should not be overtaken and passed. The system also indicates areas where overtaking and passing are permitted, and it delineates the lanes on pavements. It is a one-color, all-white pattern.

The complete painting equipment to do this work in an expeditious manner consists of an inexpensive four-wheel "Pushmobile" on pneumatic tires, a 3-ton truck, a 60 cfm. air compressor, two 60 gal. paint tanks equipped with an air motor and agitator, one 10 gal. paint tank carrying cleaning fluid, a rack to hold "Wet Paint" blocks, the necessary paint guns and auxiliary equipment.

The paint tanks are under air pressure and constantly agitated. The paint containers also are agitated previous to loading, using the appara-

tus shown in Fig. 3. To prevent clots of paint reaching the guns the paint passes a large strainer, one of the most important devices in spray painting, as it avoids many delays that would otherwise occur. The air used for atomizing the paint is provided at a different pressure than that used for operating the valves.

One, two, or three lines

There are three paint guns parallel to each other, and the paint is confined on each side of the guns by movable diaphragms that raise and lower automatically by air pressure when paint is applied. As the paint nozzles are operated from separate cams, a broken line may be painted with one, and at the same time a solid line may be painted with either of the other two, or any other combination. The central nozzle is used to paint directly over the centerline on pavements not having a center joint, such as a bituminous pavement, and the outside nozzles are used to paint close to the center line on concrete pavements having a bituminous-filled center joint.

In action the Pushmobile is pushed by a truck carrying the equipment. Steering is done by following a long arm or boom reaching out in front of the Pushmobile and supported by a small pneumatic-tired wheel that is guided parallel to the center line on concrete pavements or by sighting over a series of spots previously placed on bituminous pavements. There is a special arrangement of the tie rod in the steering device so that when negotiating curves the center between the rear wheels of the Pushmobile coincides with the small wheel on the front of the steering arm.

One man gives his entire attention to steering, and a second man operates the valves so as to place the markings in accord with symbols previously placed on the pavement. The working complement of a painting crew consists of six men, with an extra truck and driver to pick up the "Wet Paint" blocks. The method of operation is relatively simple and can be quickly learned by any skilled mechanic. The speed is usually 10 to 15 mph.

The Pushmobile, as now equipped, could be produced at pre-war prices for about $1,200, including the paint guns. Today's cost probably would

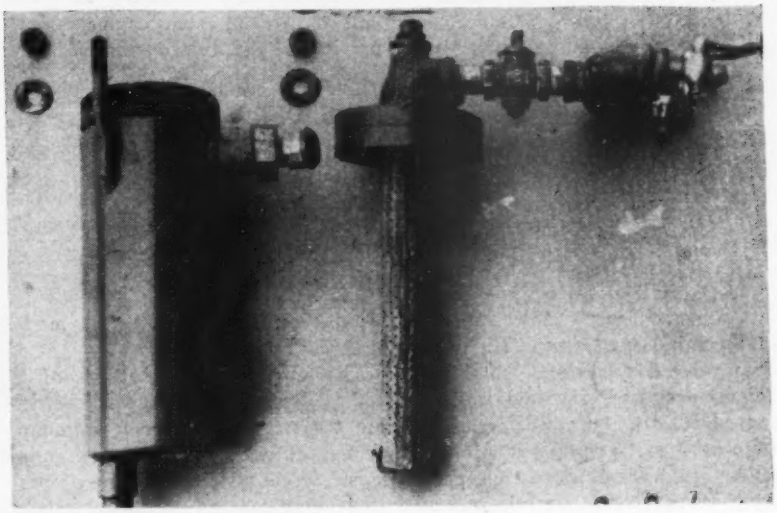


Fig. 2. Fifth wheel drives variable speed arrangement of cams that can be set to control repainting of lines to match existing markings. (Below) A strainer in the paint line prevents clogging the spray nozzles.

be $2,000. Years of experience with this equipment indicate that it is not necessary to acquire heavy-duty oil-tank type trucks to perform this work when simple and relatively inexpensive equipment is adequate; in fact, reasonably good work can be done with a two-wheel, narrow tread trailer attached to the rear of an ordinary truck. Some highway departments have frames carrying nozzles attached as an outrigger to small tractors. Much depends on the mileage to be covered, and the time factor. Equipment of the Pushmobile type also is suitable for marking city streets and is used in Rochester and Buffalo, New York, with excellent results.

In 1941 New York State used about 100,000 gal. of paint in painting and repainting lines on pavements, and in placing special markings. The total cost of this work was $175,000 for labor, material and equipment. The first painting of 400 miles of two-lane pavements in the Buffalo, N. Y. area in 1941 required about 2,600 gal. of paint and cost $9 per mile, including paint, labor and equipment. Deducting the paint, the labor and equipment charge was about $3 per mile. Multi-lane painting costs were proportionate to these figures.

Through the war period reduced traffic striping schedules were in effect and marking was done only where the sight distances were restricted, and at intersections and other hazardous points. The cost figures for 1946 have not been computed on a statewide basis, but the

1941 figures are being exceeded in both mileage and cost. The Buffalo district figures show that in painting 457 miles of two-lane pavement 3,326 gal. of paint were used at a total average cost, including all items, of $12.88 per mile. Including some three- and four-lane pavements the cost of painting has averaged 14.68 per mile. Paint costs $1.90 per gal., 20 percent more than in 1941, and figures indicate a substantial increase in labor costs.

An all-white, dash-solid system of marking is in use in New York, Pennsylvania, Virginia, Massachusetts, the Canadian Provinces of Ontario and Quebec. General use of this system seems to be in the ascendency, having been recently adopted by California, which has a greater automobile registration than any other state. When painting a broken line 4 in. wide and 15 ft. long with a 30-ft. gap, about 5 gal. of paint is used per mile. A solid or full line requires about 15 gal. per mile, and solid double lines use about 30 gal. per mile. If a solid line were used by New York State instead of a dash line for the normal center line, the cost for paint alone would be increased about $150,000 annually.

The paint apparatus described was developed under the general direction of the writer, assisted by Claude H. Naber, chief mechanic, and I. H. Beaman, mechanic at the District Highway Shop near Buffalo, New York. Maynard A. Bebee and Gilbert W. Treble, traffic engineers, supervise the marking operation.

Standard Truck Serves Virginia

Charles B. Leech, Jr.

Equipment Engineer, Virginia Department of Highways

BASED upon 18 years of development the Virginia Department of Highways has produced a machine that offers major advantages for marking the center-line of highway pavements. Not only does the equipment produce a line of uniform width, but paint losses are reduced to a minimum and rapid striping is possible at moderate cost.

The apparatus used consists of a 150-gal. storage tank, a small working tank, a rotary-gear type pump similar to that used on hydraulic hoists, and a system of delivery pipes —all mounted on a 1½-ton truck chassis. The paint flows by gravity from the storage tank through a strainer pot into the small working tank and then is drawn into the pump, from where it is forced under pressure through a pipeline and a second strainer pot to the nozzle.

Several valves control the flow of paint and the pressure upon it, a portion of the paint always being bypassed back into the working tank. The discharge pressure is varied according to the condition of the road surface and the spray is begun and cut off by hand operated valves. The width of the line of paint is controlled by two discs, one on each side of the nozzle, that roll on the surface of the road. Two sets of discs and nozzles are provided to permit painting double lines.

Five men, who normally work under the district engineer's supervision, make up a centerline marking team. They are: The driver of the truck transporting the marking machine, the machine operator, a flagman, and a driver and a helper in a second truck picking up the metal guards placed by the operator of the machine to protect the fresh paint until dry. On roads of light traffic the flagman is not required.

For two-lane pavements intermittent 4-in. lines were used at the center on tangents, and both a 4-in. line and intermittent 4-in. line used on curves, or where the sight distance was less than 600 ft.

On three-lane highways where the sight distance is less than 600 ft. two lanes of traffic are marked in one direction and one lane in the opposite direction. On four-lane undivided highways the double solid line in the center acts as a barrier, and the two lanes on each side are marked with intermittent lines.

Fig. 4. Machine used to paint traffic lines on Virginia highway pavements permits one stripe to be added alone or two lines to be painted simultaneously with either line made solid or intermittent.

Costs are reasonable

Between July 1, 1945, and June 30, 1946, about 105,000 gal. of paint were used at a cost of $1.71 per gal. This was used on some 8,000 miles of highways 16 ft. in width and wider. The average daily progress of a single machine was 13 miles for two-lane highways, using about 13 gal. of paint per mile, at a cost of $25. For three-lane highways the daily progress averaged 10 miles, using about 26 gal. per mile, at a cost of about $48.

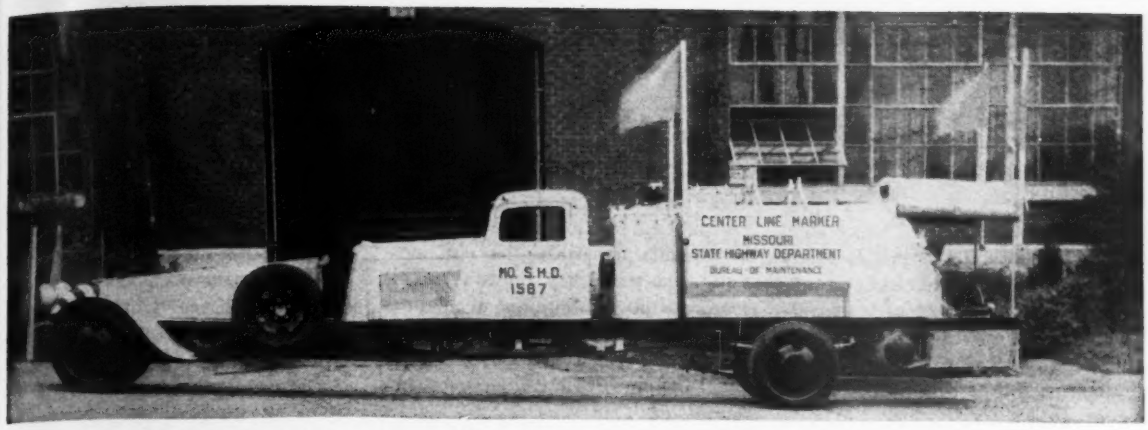


Fig. 5. Missouri's center-striping machine was made from a drastically remodeled 1½-ton truck.

Missouri Paints with Narrow Rig

R. P. Cummins

Superintendent of Equipment, Missouri State Highway Department

A 36-ft. long narrow-tread self-powered machine is used by the Missouri State Highway Department for painting stripes on pavements.

Although unusual in appearance, the machine has proved quite satisfactory in applying both the solid centerline stripe and the intermittent, or dashed, stripe on the centerline of traffic lanes in "no passing" zones.

During 1946 Missouri used 53,350 gal. of paint in striping 3,100 miles of pavement. Cost, exclusive of paint, was $27,321 for labor, materials, and rental charges on equipment. This is a little less than $9 per mile and about $3.56 per hr. for the 768 hr. the equipment was operated this year.

To minimize interference with traffic, the chassis of the 1½-ton truck from which the striping machine was made in the highway department's headquarters garage, was cut down to a tread width of 3 ft. and an overall width of 4 ft. The truck chassis also was lengthened to a 26-ft. wheelbase and an over-all length of 36 ft.

These changes were made by cutting the truck lengthwise through its centerline and narrowing the frame, cab, differential and axles. The frame was lengthened 12 ft. and the steering mechanism was rebuilt to suit the narrowed tread. Position of the engine, transmission and differential were not changed.

The center-striping machine is equipped with a 450-gal., three-compartment paint tank. A connection from each compartment to a paint nozzle mounted at the rear axle permits the operation of any or all three nozzles at one time. Paint is transferred from barrels to the paint compartment either by a paint pump driven from a power take-off mounted on the truck, or by a hoist that permits dumping a barrel of paint directly into the paint compartment.

The machine is equipped with a dot-and-dash mechanism, developed by A. V. Spencer, one of the department's general inspectors, that is used on bituminous surfaced roads. Through the medium of this mechanism the lengths of dots and dashes can be regulated to any desired pattern.

Operation explained

Compressed air for operating the paint nozzles is supplied by a 6-cfm. compressor mounted on one side of the truck frame, and driven by V-belts from the transmission power take-off. An air-receiving tank on the rear of the truck frame supplies air at 6 to 15 psi. to force even flow from the paint nozzles but the paint is not atomized for spray application. These nozzles are the type that cut off short the flow of paint to prevent "stringing" on the pavement.

In addition to the driver's cab, there is a cab at the rear of the unit for the paint operator. The rear cab provides storage space for wooden blocks carrying red flags which are dropped on the newly painted stripe to keep traffic off the freshly painted lines. These wooden blocks are placed in position on the pavement while the striping unit is in motion. A metal chute, which extends from the rear cab down to a point just above the pavement, is designed so that the blocks with a flag attached, set upright when they contact the pavement.

A speaking tube between the front and rear cabs permits communication between the driver and paint operator while the striping is in progress. A 12x24-in. mirror mounted on the front end of the truck is focused so that the driver can see that the center of the axle is over the center of the pavement at all times. This assures him that the paint nozzles at the rear of the truck are in proper position.

Cost to build the machine described was $2,725 but it is estimated that it would cost $3,750 to duplicate it.

In general, Missouri uses a solid black line to indicate the centerline of portland cement concrete and other white-surfaced rigid pavement. For bituminous pavement a solid white line is used on curves, and a dashed line (10-ft. stripe at 30-ft. intervals) on tangents, to indicate the center line of pavement. In no-passing zones a dashed yellow line is used exclusively. Here a variation from striping practice is used. The dashed yellow line is placed on the center of traffic lanes, where it is believed to be more effective, and the paint longer lasting than when the stripe is placed at the centerline of the pavement.

Dangers of Highway Bankruptcy

R. H. Baldock
Oregon State Highway Engineer

CONDITIONS that lead to bankruptcy may come about in the management of state highway affairs just as surely and with the same disastrous results as in the management of a private business venture. In the case of the state highways, however, because of the long period of time involved and the fact that popular support may be secured on occasion for new bond issues to pour into the venture new life blood in the form of additional funds, there is danger that the true state of affairs may not be generally recognized. Nevertheless, the underlying principles are there and in long-range thinking about highway financing it is not logical to overlook the possibility of bankruptcy. In some cases it may be rapidly becoming a perilous probability.

The obligations of any state highway department would appear to be in the following order: (1) Debt service, that is, taking care of the principal and interest on any outstanding bonds, (2) administration, maintenance and operation, (3) depreciation and (4) extensions and betterments. While most states recognize the relationship between items 1, 2 and 4, apparently many do not give proper consideration to item 3, that of depreciation.

Depreciation studies important

Any plant depreciates both structurally and functionally. Of the two, functional obsolescence is by far the more serious cause of depreciation. Proper routine maintenance can more or less care for structural deterioration within certain limits but no amount of maintenance can have any effect upon functional obsolescence. Nearly all highways built a quarter of a century or more ago are in the main obsolete while many built more recently are rapidly becoming so.

In many sections, not only is it necessary to improve gradient, curvature and width, but in many cases the requirements of modern traffic demand a complete relocation and an entirely new road. Under such conditions there is a loss of the right-of-way, grading, structures, and all other highway facilities; in fact, a 100 percent depreciation. In some cases it is possible to utilize the old location as a secondary highway. This requires the assumption of maintenance and operation costs which, as a carrying charge, may ultimately equal the cost of immediate depreciation.

Some 17 years ago this writer began to study this subject and 10 years ago caused to be set up in Oregon a system of investment accounting to measure the cost of depreciation. To this end during 1935 and 1936 complete physical inventory of all facilities was made and the present worth established as of the end of 1934. It was contemplated that at intervals other physical inventories would be taken in order to check the book value of depreciation. The original book values were based upon the depreciation rates measured in the 20-year period previous.

The shortage of manpower prevented making a physical inventory of this kind during the war years and there has not been time since to make one. However, spot checks indicate that the book value of the rates is approximately correct. Any depreciation study depends upon the assumed service lives of the various types of facilities, which range, as far as the Oregon State Highway Department is concerned, from about 12 years for wooden bridges and 30 years for standard pavements to 50 years for major bridges and the like. On only 15 percent of the roads is investment in grading work depreciated on the assumption that the grades would last indefinitely, as far as structural deterioration is concerned.

Keeping the system solvent

The average depreciation rate thus far found applicable to highway facilities in Oregon is 2 percent, which would involve a service life of 50 years and appears very conservative. However, on this basis, the present annual depreciation expenditure in Oregon required from current revenues to keep abreast of the depreciation rate is $5,000,000. This amount will increase during the next 10 years to an average of about $8,500,000 per year and, in the following 10 years, to an average of about $12,000,000.

It is expected, however, that some savings will result in current maintenance cost by reason of the restoration of depreciated facilities. It is quite apparent that, unless proper study is given to restoration of depreciated facilities each year from current revenues as a "must," the state might overextend itself. It is quite possible that such over-extension could reach the point where the state could no longer carry its obligations without materially increasing revenues or by issuing bonds to care for depreciated facilities.

There is always resistance to increases in taxes and it is quite possible that an obligation may be deferred so long and assume such proportions that any tax proposed to be levied to take care of the accumulated deficiencies would be confiscatory. Moreover, the issuance of long-term bonds to care for such expenditures will almost double the cost. Either procedure is questionable and indicates a condition of state highway department bankruptcy. Therefore, there appears need for a careful review of the financial structure of the state highway systems and of the economic studies.

The depreciation of the highway dollar, which is now worth about 66⅔ cents, has aggravated this condition. In many states the situation is no longer a problem in obscure economics but is readily discernible because of increased obligations and depreciated currency.

Road building has lagged behind during the years of economic depression and the years of war, and there is a great need for better highways. During the next 20 years enormous expenditures should be made to give the United States the highway transportation required for its economic growth. Taxes must be held in line with benefits, proper regard must be given to depreciation, and the systems must be kept solvent. Study should be made in each state as soon as possible of a long-range plan and benefits to road users from contemplated road improvements should be determined in relation to fees and taxes necessary to accomplish this objective within a given period of time.

Practical Lessons in Caisson Sinking From the Baton Rouge Bridge

E. S. Blaine
Mobile, Ala.

***Contents in Brief** — Experience gained in the hard way in sinking open caissons through sand islands for the Mississippi River bridge at Baton Rouge, La., leads to useful conclusions on erosion hazards, friction bond, water-jet action and weighting. A caisson and cofferdam design that provides for weighting appears the soundest method of ensuring accident-free work. By narrowing the waterway sand-islands may develop dangerous erosion.*

THE BATON ROUGE BRIDGE across the Mississippi is one of the three great bridges built during the thirties in which the sand-island method of caisson sinking by dredging has been brought to its highest development. The other two structures were the Suiran Bay bridge (*ENR*, Jan. 20, 1930, vol. p. 174) in California and the Mississippi River bridge (*ENR*, May 10, 1934, vol. p. 509) at New Orleans, La. A general description of the bridge at Baton Rouge, with an account of the foundation difficulties, was published in *Engineering News-Record*, Jan. 20, 1938, vol. p. 106. Of the three bridges this was most notable for mishaps interrupting foundation construction.

Because of these mishaps and other lessons gained in sinking open caissons, the writer, who was on the construction engineers' staff, is prompted to review some of the details of the work that have not been previously published. It is believed that some of these facts of experience will have value in conducting foundation work by the sand-island method and in sinking open caissons by dredging.

Since the Baton Rouge Bridge is some years back in the memories of most readers a brief description of the structure follows. Fig. 1 is a diagram elevation of the main channel structure. Two approach viaducts increase the total length to 2.31 mi. Other significant dimensions are given by the drawings. The main channel trusses rest on six piers, one founded on piles and five on open caissons of reinforced concrete sunk through sand islands. The caisson for Pier 1 was circular, the others were rectangular and were divided by partition walls into twelve dredging wells.

Founded on sand, clay

The locations is the middle of the alluvial valley of the lower Mississippi River. There is no rock at possible foundation depths and no rock outcrops for long distances. The ground to great depths consists of strata of sand, clay and mixed sand clay of various consolidation characteristics. The river bed is highly erodable. Particular ground conditions are noted later.

Knowledge of the sand-island construction is important in understanding some of the mishaps that occurred. Sand islands were used for Piers 2 to 5, inclusive; the two of most importance being for the channel Piers 3 and 4, which, by the terms of the contract, had to be constructed at the same time. In each location the island consisted of a cylinder of $\frac{5}{8}$-in. steel sunk into the river bed within a ring of pile wharf and filled with sand. To seat the steel shells the river bottom was merely dredged level except at Piers 3 and 4 where woven board mattresses 250 x450 ft. were also sunk to prevent scour. The shell for Pier 4 was 111 ft. and for Pier 3 was 121 ft. in diameter.

Provision against scour at these piers was indicated by low water velocities of 2 to 3 mph. and flood velocities of 6 to 8 mph. As it developed, the board mattresses gave little if any protection against flood currents.

The possibility of a sand-island washout, with a huge concrete caisson still perched on it many feet above the river bed, is something that justifies profound consideration of erosion hazards. This possibility oc-

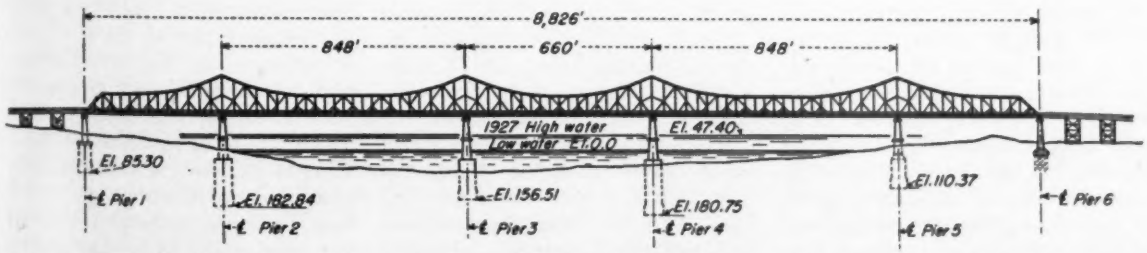


Fig. 1. Cantilever road and railway bridge at Baton Rouge, La., is carried on one pile pier and five piers founded in concrete caissons sunk through deep alluvial clay, sand and mixed sand and clay.

curred at Baton Rouge; a washout of the sand island for Pier 4 did occur when the caisson had penetrated the river bed only about 15 ft. Again at Pier 3, scour at one time had, less than 100 ft. away, dug out the river bed to a depth 40 ft. below the bottom of the steel cylinder holding this sand island.

Restriction of the river channel by the sand islands caused excessive bed erosion. At the bridge site the river channel is 2,400 ft. wide at low water between stable banks. The sand islands and wharves narrowed this channel by about 320 ft., and the contract required both caissons to be sunk at the same time. The construction of one foundation at a time would have lessened erosion. As it was, the scour was 50 ft. deep around Pier 4 and 40 ft. deep around Pier 3.

At Pier 4 the scour was too great for the mattress protection to resist. The sand-island shell was undercut at one point and the sand fill ran out as if it were so much quicksilver. Within 2 or 3 min. it had completely disappeared and the steel sheel on the side of the runout was forced in against the caisson and torn. The caisson, which had a river-bed penetration of only 15 ft. was tilted 7 ft. east in line with the bridge and 2 ft. south.

For some three months following the accident the entire contractor's organization was occupied in protective work against futher scour, in plumbing and deepening Caisson 4 and in correcting other flood-season mishaps. The details of these operations have no material bearing on the lesson: *The sand-island method of caisson sinking is a potential erosion hazard.*

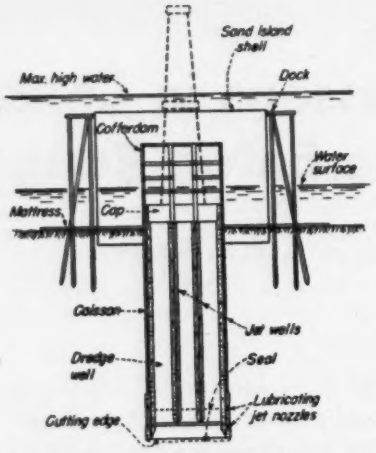


Fig. 2. Across-bridge section of assembled structures used in foundation construction at the Baton Rouge bridge.

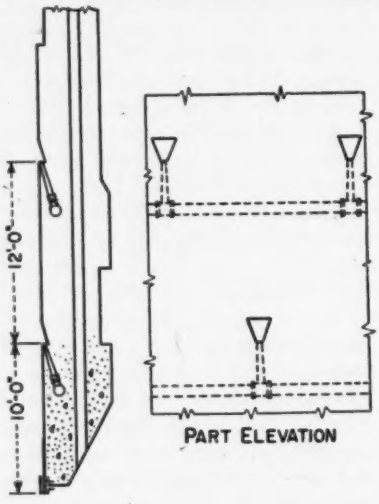


Fig. 3. Detail of water-jet arrangement embodied in the caissons for the Baton Rouge bridge, which proved of little value in clay and dangerous in sand.

Friction determinations

Contractors who specialize in caisson sinking predict the force of friction that the caissons must break in sinking by dividing the net weight of the caisson (gross weight less water displacement) by the area subject to friction and expressing the result as friction per square foot. Using this method friction in pounds per square foot was computed at favorable opportunities during the sinking of each caisson. Results obtained were as follows in pounds per square foot:

Caisson 1; water-tight stiff clay; 800 lb. Caisson 2; tight-clay grading to very sandy clay; 350 lb., reduced to 647 lb. by means of lubricating jets. Caisson 3; 31 ft. sand grading to gravel, 15 ft. mixed clay and sand, 40 ft. stiff clay, 10 ft. clay and sand, 6½ ft. gray sand; 845 lb. Caisson 4; 47 ft. sand and clay, 53 ft. sand, balance sand and clay; 736 lb. Caisson 5; 28 ft. silt, 98 ft. fine sand; 1,126 lb., 1,123 lb. and 1,120 lb.

The computations at Caisson 5 were made at penetrations of 92, 100 and 110 ft., that is when the caisson was deep in the fine sand structure, and the sand bond obviously controlled the friction values. *Of all the materials penetrated fine sand offered the greatest friction resistance to caisson sinking.*

Interesting experiences were had with friction reducing devices. Four of these built into the caissons were: (1) The bottom 30 ft. was made 6 in. larger all around than was the shaft above; (2) the partition walls were bottomed about 7 ft. above the cutting edges of the shell walls; (3) circular 8-in. wells extending from top to bottom were molded in all walls at regular intervals, and (4) a system of pressure-jetting pipes and nozzles was built into the exterior walls all around. All these devices are indicated by Fig. 2.

Blasting aided sinking in clay

It was found in sinking that all materials penetrated squeezed in tight above the 6-in. ledge and there was no evidence that friction was reduced by bottom enlargement of the caisson. The shorter partition walls made sinking easier and provided very useful clear space for cleaning the bottom and placing the concrete seal. In clay, the wall wells were necessary to place dynamite charges under the cutting edges to shoot away compacted clay which was out of reach by the clamshell buckets. In sand, material is not likely to compact under the walls.

At Caissons 2, 3 and 4, blasts under the caisson shell, made possible by the wall wells, were employed to break the friction by shaking the caisson. This procedure gave little or no success in sand. At Caisson 2, where the material was clay, more good was accomplished although how much was due to removing compacted clay beneath the cutting edges and how much was due to the shake or jar could not be measured. *In sand, blasting is a method of desperation which seldom does any good and usually starts "run-ins."*

Analysis of the jetting system presents complexities. Jets were placed in the lower part of the shell walls as indicated by Fig. 3. The pipe and nozzle sizes and arrangement were a part of the caisson design. There was no occasion for jet operation at Caisson 1 and the following description applies only to the rectangular caissons. In all of these jetting was employed at one time or another.

Each rectangular caisson had two

DATA ON THE SINKING OF THE CAISSON FOR PIER NO. 5

Date	Water Surface Elev.	Ground Around Caisson Elev.	Cutting Edge Elev.	Height Subject To Friction Ft.	Net Weight Of Caisson Kips	Area Subject To Friction Sq. Ft.	Friction per sq. ft. Caisson Would Break Kips	REMARKS
Aug. 16, 1938....	+17.0	+15.3	−67.2	82.5	15,686	21,851	.763	See Note Below
Nov. 21, 1938...	+ 8.8	+ 3.6	−87.2	90.8	26,913	23,900	1.126	Caisson stopped. Weight Added.
Dec. 3, 1938.....	+ 8.8	+ 3.4	−96.0	99.4	29,396	26,170	1.123	Caisson stopped. Weight Added.
Dec. 15, 1938....	+ 4.8	+ 3.3	−105.2	108.5	31,987	28,552	1.120	Caisson stopped. Weight Added.

Note Using air and water jets. Material running under cutting edge and forming a crater around the caisson. The ber settling an amount approximately equal to the lowering of the ground surface around the caisson.

tiers of jets extending entirely around it. One tier of jets was located 10 ft. above the cutting edge and the other 12 ft. above the first tier. There were 23 jets in each tier in each rectangular caisson or 46 to a caisson. The jet nozzles were cast into the caisson walls pointing upward at an angle of 15 deg. from the vertical, Fig. 3. The nozzles were 2 ft. long, with a 3-in. connection and a 1¼-in. tip. The manifolds were 4- and 6-in. pipe connected to separate 8-in. risers for each tier of nozzles on each side and each end. *These lubricating jets as designed and located were of little value in clay and very dangerous in sand.*

Experience was conclusive. It was found that the water from the jets followed the line of least resistance which was down and under the caisson. Run-ins at every caisson followed jet application. When nozzles pointing upward were used in sand the sand ran into them as soon as the water pressure was removed and filled the manifolds so that they could not be used again. The best position proved to be horizontal. They were installed that way at Pier 2. The experiment was tried of turning low-pressure air into some of the jets. The thought was that the air would be more likely to rise up than to flow down the caisson walls and so the chance of run-ins would be less. The air did rise but in a short time the nozzles plugged air tight by material that ran in and probably was dried hard by the warm air.

Knowing that jet water would follow the line of least resistance whether it was down the caisson and under the cutting edge or up the shaft wall it was reasoned that the best location for jets would be midway of the depth of penetration. This conclusion was given application at Caisson 2. Here the contractor at his own expense installed an additional tier of jets 73 ft. above the cutting edge. The conventional calculation showed that the caisson would become light when its penetration was 120 ft. The already designed tiers of jets were 10 ft. and 25 ft. above the cutting edge. At the elevation of 73 ft. the additional tier of jets was, at 120 ft. penetration, midheight of the penetration depth above 25 ft.

Actually the caisson stuck at 129½ ft. penetration. The computed friction at this point was 850 lb. per sq. ft., which, it will be noted, checks with the value for the same material at Caisson 1. It was thought that the jets of the 10 ft. tier might be of some value in this tight clay but a trial resulted in the pump water coming under the caisson walls and up the dredge walls and these jets were abandoned. The jets at 25 ft. and 73 ft. were operated intermittently until the caisson was bottomed. The friction value of the water-lubricated clay was 647 lb. per sq. ft. A rough calculation indicated that the two tiers of jets effectively reduced friction on a 44-ft. zone of caisson shaft.

It is believed that this clay material, together with the advantageous location of two tiers of jets, gave about the maximum reduction in friction that could be expected from the use of water jets.

Weighting caissons

None of the caissons at Baton Rouge were designed to be weighted to aid in sinking. Weighting was finally forced on the contractor at Caisson 5 by the failure of all other resorts. The accompanying table shows the sinking progress. Briefly, about Aug. 1 the friction and the net weight of the caisson balanced and the caisson hung up at El.-64.52. Dredging was continued, using the built-in jets and, after these had plugged, using 92 water and air jet pipes put down outside the caisson. Material dredged from inside the caisson was continually replaced by material from the outside running under the cutting edges. The caisson had been lowered 9 ft. by Oct. 6 when the crane foundations collapsed. This 9 ft. was not penetration in the usual meaning because cratering due to run-ins had lowered the ground around the caisson by about the same amount. The friction value per square foot had not changed appreciably. The caisson had to be altered to permit weighting.

A 10-ft. cap of reinforced concrete was placed, leaving a hexagonal opening just large enough to pass a 2-yd. clamshell over each dredge well. Wood casings were built around these openings to a height of 50 ft., and the cofferdam was built to take internal pressure. Saturated sand dredged from inside the caisson was deposited inside the cofferdam to weight it. The cofferdam was heightened and the sand load was increased four times as shown by the table to sink the caisson to grade. In all 7,500 tons of load was added to the caisson.

This experience at Caisson 5, destruction of the cofferdam by a run-in at Caisson 4; the closely threatened cofferdam failure at Caisson 3, and the anxious fight against run-ins and craterings at all but Caisson 1 indicates the desirability of designing all caissons so that they can be weighted. The construction adopted at Caisson 5 meets requirements. When a caisson is so designed it is free from the danger of destruction by "run ins." Dredging is slowed some because of the smaller dredging wells but the added weight will more than compensate for a decreased dredging rate, by eliminating the expensive delays that always occur when attempting to sink a light box.

Construction that would permit this temporary loading requires the pouring of the caisson cap before placing the cofferdam, leaving openings just large enough to pass the clamshell buckets. These openings should be circular or octagon shaped with anchor bolts around the edge to take the dredge well casing.

Flat Slabs on Cast-Iron Columns Increase Usable Space

Contents in Brief—*In a hog-cooler building for a meat-packing plant, the designers solved a corrosion problem and added useful interior space by employing unprotected cast iron for interior columns supporting all-flat-slab floors. Capitals and drop panels were eliminated under the ceilings by incorporating in the slabs steel-channel grillages attached to the cast iron columns. These grillages supply needed shear resistance around the columns. The resultant clear space has many advantages for a processing plant.*

CORROSION resistance and increased useful cubature were twin determinants leading to dual selection of cast-iron columns and flat-slab floors, without drop panels or column caps, for a hog-cooler building in a meat-packing plant of Wilson & Co., at Cedar Rapids, Iowa. Cast iron was chosen for interior columns because it requires no protection and, in combination with all-flat-slab floors, furnishes the greatest usable cubic content, free from obstructions common to other types of construction. To eliminate underfloor support around the columns, steel grillages were embedded in the slabs. The grillages are supported on the columns by a specially designed flange cast with the cylindrical iron members.

Comprising five stories and a basement, the hog-cooler building is 98x180½ ft. in plan. Story heights vary from 11 to 14½ ft., floor to floor, and the top story has variable vertical clearance under a pitched roof ranging from 16 ft. at the middle of the building to 14 ft. at the two ends.

Constructed as a unit in an integrated meat-packing plant, the cooler building receives hogs after killing. Slaughtered hogs enter the building by chain conveyor on the third floor through a vestibule at one end. An inclined chain conveyor thence carries the hogs to the fifth floor and distributes them to hanging rails where the carcasses are chilled. The hogs are processed into various products in the lower stories.

Framing for the exterior walls is entirely of reinforced concrete, both for the columns and for the beams which support brick closure panels. The reinforced-concrete exterior columns are rectangular in section, designed flush with the brickwork to furnish an unbroken interior surface for application of wall insulation. Columns at corners of elevator shafts and stairwells also were designed in reinforced concrete to simplify framing of reinforced-concrete beams around the column openings.

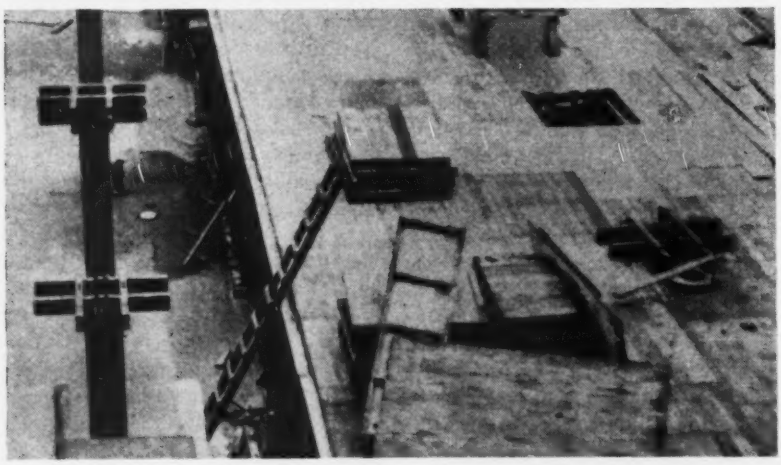


Fig. 1. Round cast-iron columns designed to support steel-channel grillages incorporated in the reinforced-concrete floors eliminate corrosion troubles in processing plant, allow maximum use of floor space and permit construction of flat ceiling without capitals or drop panels around columns.

Preliminary studies

Before deciding on the final design, preliminary designs and estimates were made of the building for three types of columns: reinforced-concrete columns throughout; steel H-sections fireproofed with concrete for the in-

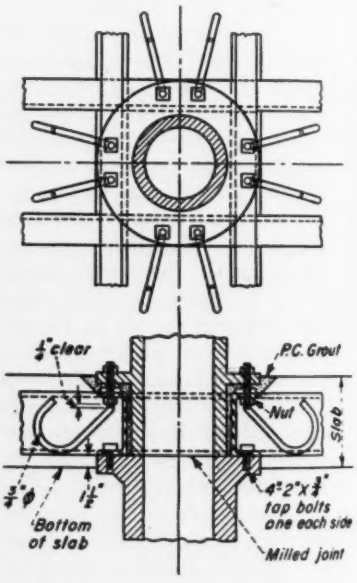


Fig. 2. Special flange at top of cast-iron column supports channels of rectangular steel grillage which furnishes shear resistance in surrounding all-flat slab. After floor slab has been concreted and next section of column has been set, space between steel channels and column barrel is grouted.

terior columns; round cast iron for the interior columns. Cast-iron columns were adopted because they require no protection against corrosion, take up less floor space, and (in combination with all-flat slabs) provide the most satisfactory structure, considering durability, economy, flexibility for running pipes and ducts on the ceilings, and elimination of dead air pockets under the ceiling.

Interior round cast-iron columns are spaced 18½ x 20 ft. on centers. Floor slabs are 9¼ in. thick, designed for a loading of 200 lb. per sq. ft., which includes both live load and applied load of floor paving and insulation. The roof slab, designed for 125-lb. live load, is 8 in. thick.

Cast-iron interior columns vary from 15-in. dia. in the basement to 8-in. in the fifth story. Steel grillages made of channel sections (Figs. 1 and 2), attached to the cast-iron columns and embedded in the floor slabs, act as shear members and replace the usual concrete capitals or drop panels. At the wall columns, neither grillages nor brackets are used to develop shear resistance.

Exterior walls, roof, and the fourth and fifth floors are insulated with the packing company's own insulation product, made up in the form of boards. The insulation on the walls is covered with glazed tile which extends from the floor to the ceiling in each story. Roof insulation is placed on top of the concrete slab and is topped with bonded built-up roofing. Floor slabs for the fourth and fifth stories are insulated on the bottom. The insulation was laid on the slab forms, with anchor inserts projecting upward, and the reinforcing steel was set on top of the insulation before concrete was placed.

Concrete floor slabs were finished to level grade and covered with water-proof membrane. Over the membrane, a concrete fill was placed to provide pitch to drains, and a wearing surface of vitrified paving brick was laid on the concrete fill to provide a finished floor which would not deteriorate under conditions existing in the meat processing plant. These conditions, which cause rapid corrosion of ordinary steel, were a major influence in the decision to use cast-iron interior columns.

Cast-iron column sections were made in story heights, and construction of the building moved upward story by story. To protect the column heads for erection of the next tier during placing of floor slab concrete, wooden templates (Fig. 3) were fastened over the rectangular openings in the centers of the steel-channel grillages. The template served also to hold the anchor bolts in proper position for erection of the next column section (Fig. 2). After the next section of column had been set, the space between the steel channels and the cast-iron barrel was filled with grout.

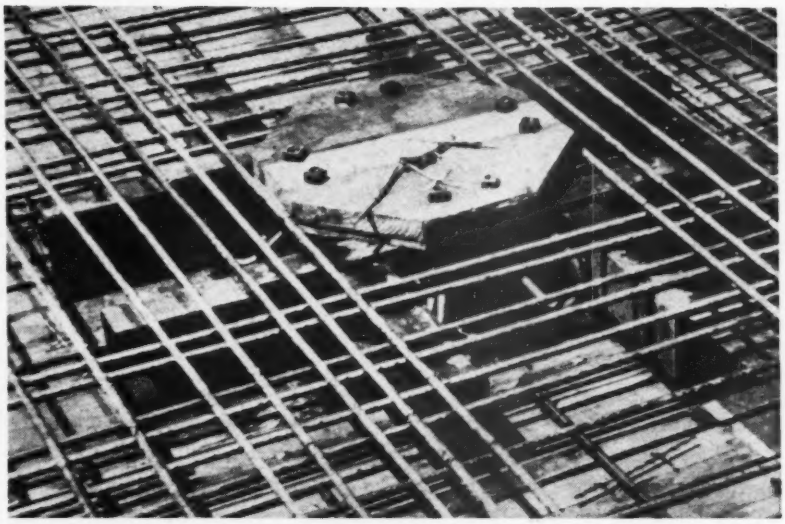


Fig. 3. Wooden template covering rectangular space in center of steel-channel grillage holds column anchor bolts in position and protects space from being filled while concrete is placed in floor slab.

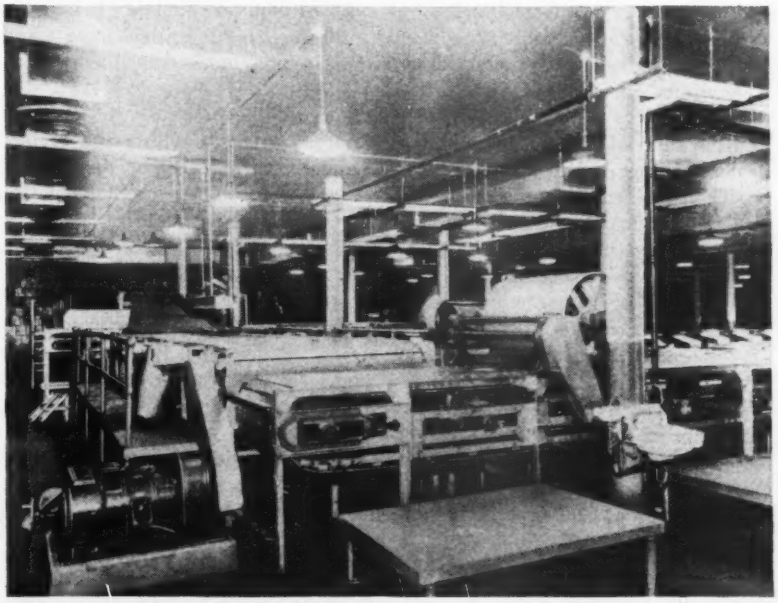


Fig. 4. Additional usable space resulting from use of small round columns and all-flat ceilings furnishes distinct advantages for installation of under-ceiling ducts and piping, as well as processing equipment.

Plans and specifications for the hog-cooler building were prepared in the engineering department of Wilson & Co., Inc., Chicago. This department also supervised construction. A. McKenzie is chief engineer, and M. J. Hess, architectural engineer, for Wilson & Co. Walter H. Wheeler, Minneapolis, was consulting structural engineer. Sumner L. Sollitt & Co., Chicago, erected the building.

BUILDING DESIGNERS' LIBRARY

Suggestions for Safe Lateral Bracing Design

C. Mortimer Throop
Associate Engineer, Seelye, Stevenson & Value
New York, N. Y.

Contents in Brief—The forces to be used in designing lateral bracing of steel members may be calculated from known forces and assumed eccentricities. To function properly, the bracing must not only be capable of sustaining these loads but must be connected to some rigid point.

THE FORCES used in determining the necessary strength of lateral bracing of steel members, except for wind or specified lateral forces, is usually left to the judgment of the designer. Therefore, in designing bracing, it is necessary to assume an eccentricity on the basis of which a force may be calculated for design purposes.

Typical examples of members requiring lateral bracing are given in Fig. 1. The eccentricities shown are caused by possible inaccuracies of fabrication or construction and by buckling in unbraced compression members and unbraced compression flanges of beams. The usual formulas for allowable unit stresses in columns and unbraced beam flanges are used to determine the section for main members. To determine the force to be used in the design of bracing for a column, it is assumed that the column is erected so that it would be one inch out of plumb if the story height were 100 in. This is equivalent to assuming a horizontal component of one percent.

In all the cases shown in Fig. 1, the eccentricity will cause a force directly proportional to the load and inversely to the unsupported length of member. The general practice in our office is to design all members not subject to an actual lateral force for a stress of not less than two percent of the direct stress for compression members and two percent of the compression-flange stress for beams.

Bracing should have rigid support

However, it is not enough just to add a steel member. The bracing must be secured to some point that has adequate rigidity, such as another column or a beam held by floor framing. If the brace is between two columns, moment connections or knee braces or cross bracing should be used. The brace for the condition shown in Fig. 1 (e) should have a stiff connection based on load and eccentricity. All braces, besides being capable of sustaining two percent of the stress, should also be within the limits of stiffness required by code or good design.

Truss bracing has three functions: insuring against overturning, stiffening of compression chords and withstanding erection loads in addition to wind. Erection braces are usually cross braces in a vertical plane at the center and ends of a truss, while other bracing is usually horizontal in the plane of the top chord.

Another type of lateral bracing is that provided steel members by various types of floor construction, such as reinforced concrete slabs, wood joists and planks, steel joists, steel deck and precast concrete units. The

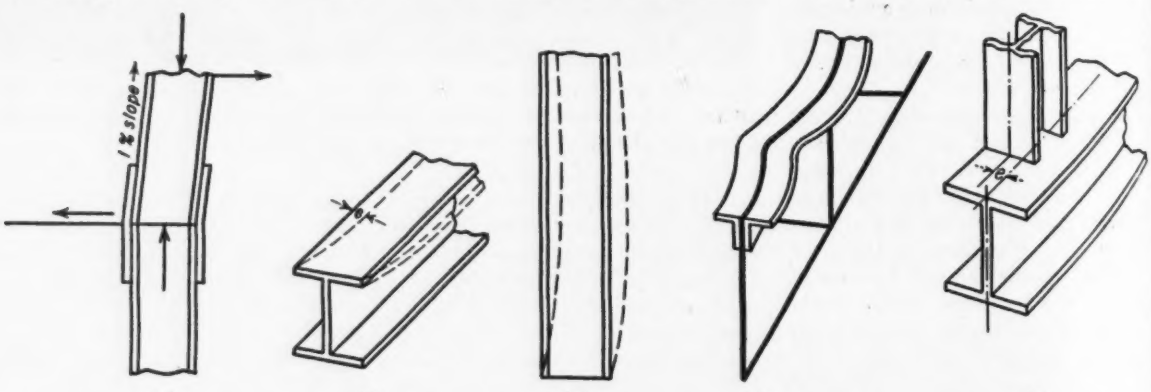


Fig. 1. Typical examples of members requiring lateral bracing. From the known loads and assumed eccentricities, forces can be computed for use in designing the bracing. Eccentricities may be due to fabrication or construction inaccuracies.

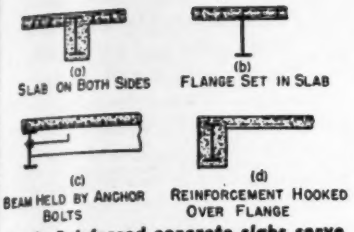


Fig. 2. Reinforced concrete slabs serve adequately as lateral bracing.

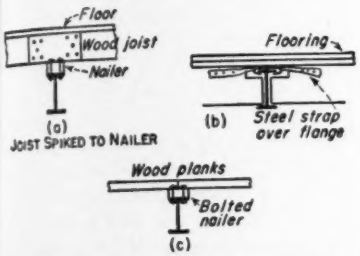


Fig. 3. Properly anchored wood joists function as lateral bracing of beams.

adequacy of this bracing is dependent on the use of proper details, as indicated in Fig. 2, 3 and 4.

Reinforced concrete slabs (Fig. 2) provide reliable bracing when occurring on both sides of a beam or if anchored over or through a member when the slab is placed on one side only. Wood joists that rest on and are spiked to nailing blocks bolted to a steel beam and that have nailed to them a wood floor or sheathing provide good bracing (Fig. 3a). When wood joists are framed to the web of a steel beam, however, metal straps should be provided alternately from each side to prevent movement (Fig. 3b).

Bar joists are ordinarily provided with light metal clips, which give questionable anchorage. Welding of the joists to the carrying beams will make standard joists with concrete slab or nailer joists with wood floor reasonable bracing (Fig. 4a).

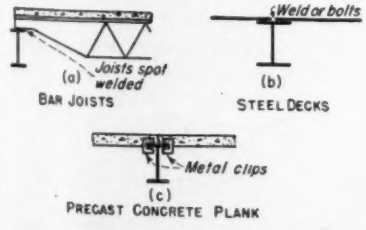


Fig. 4. Whether bar joists, steel deck, or precast concrete slabs act as suitable bracing depends on their connection to the beam.

Steel decks that are either welded or bolted to steel beams will act very suitably as lateral bracing (Fig. 4b). On the other hand, it is debatable whether steel beams are adequately braced by precast concrete planks. It is true that the clips that are provided with the plank when hooked over the beam flanges will prevent movement if properly installed (Fig. 4c). However, their main function probably is to prevent uplift due to wind suction. On flat roofs, with light framing, they probably provide a proper brace and have been used considerably, but they should not be considered as a brace for a truss or a girder. If there is any question as to the bracing value, tie rods or light angles should be placed at sufficient intervals between supporting members.

The question of lateral bracing of columns usually arises in connection with relatively long wall columns. The columns are generally adequately braced for l/r in the strong direction but to utilize lighter column sections, intermediate braces are used to reduce l/r in the weak direction. Also, there are times when, due to architectural clearances, columns are braced only in one direction at floor level by the main members of the structure. The required bracing for these conditions may be installed as previously outlined.

There is probably much more that could be written about this subject both from a practical and theoretical viewpoint. Since the average designer does not have the time to analyze all secondary stresses, the use of the foregoing ideas may supplement his judgment.

Phoenix Water Supply Improvements Will Meet Needs to 1970

SUMMER PEAK demands on the domestic water supply at Phoenix, Ariz., have increased to such an extent that it is now necessary to expand the supply and provide more storage to maintain adequate pressure for fire protection. Accordingly, plans have been laid to make system extensions that will take care of expected needs to 1970. Contracts for $1,500,000 or about one-fourth the work had been let as this was written.

Principal supply for the city comes from the Verde River, some 30 miles northeast of the city. There, by means of 4,000 ft. of open joint pipeline and fourteen wells along the river bank, water is made to flow through a natural filter into the municipal system. The river bed and the bank gravels will deliver 30 mgd.—when the river is running clear—into the collecting system. Muddy water in the river seals up the surface channel gravels so much that at times the capacity of the collection system is reduced to a low of 12 mgd.

In 1940 the Salt River Valley Water Users Assn. constructed the Bartlett Dam. The operating program for the reservoir behind that dam is to get rid of silt by flushing it out into the river below. This has greatly reduced the efficiency of the infiltration system serving the Phoenix water supply and has put additional burden on wells from which water is pumped in the city and some 8 or 10 miles to the east. Since quality of water in these wells is poorer than that taken from the Verda the wells are used only when the river supply is inadequate.

Large demands on system

In addition to the 120,000 population now served by the city water system, several thousand residents outside the city limits are applying for municipal water service. This the city has been unable to grant because of its inadequate supply.

The city's average demand ranges from a January low of 13 mgd. to a July maximum of 42 mgd. The corresponding per capita range is from 108 to 350 gal. per day. The maximum hourly rate is 475 gal. per capita per day. During such an hour, with a demand rate of 57 mgd., pressures at weak points in the system drop as low as 20 psi. as compared to the 40 psi. requested by the Fire Underwriters.

To rectify this situation and bring the supply to a volume that affords a reasonable margin of safety above the underwriters' requirement, Phoenix

voters last November approved a $6,000,000 bond issue to increase the supply and to extend and enlarge the distribution system. This bond issue gained popular approval partly on the good record of the city water department. The record shows a net operating profit (after paying all operating costs, bond interest and depreciation) which has been steadily increasing through the years to over $364,000 for 1944-45 and $374,000 for 1945-46. These profits are expected to increase further as the water service is extended by the additional supply provided for in the current bond issue.

The $6,000,000 is to provide a supply that will meet all needs until 1955, at which time the maximum hourly demand will be at the rate of 79 mgd., as shown in the accompanying diagram.

How supply will be increased

This additional supply is to be obtained from increased storage behind Horseshoe Dam developed by spillway gates to be installed on this dam at a cost of $800,000. The 75,000 acre-ft. capacity thus provided, allowing for evaporation, seasonal variations, etc., is estimated to net 20,000 acre-ft. per year for the city's system.

Also, 3 miles above Granite Reef Dam pumps are to be installed to lift surface water from the Verde River to a filter plant which will have a capacity of 30 mgd. Use of this plant, which is estimated to continue for not more than 3 months per year, is expected to bring the present supply up to the 1955 requirement of 46 mgd.

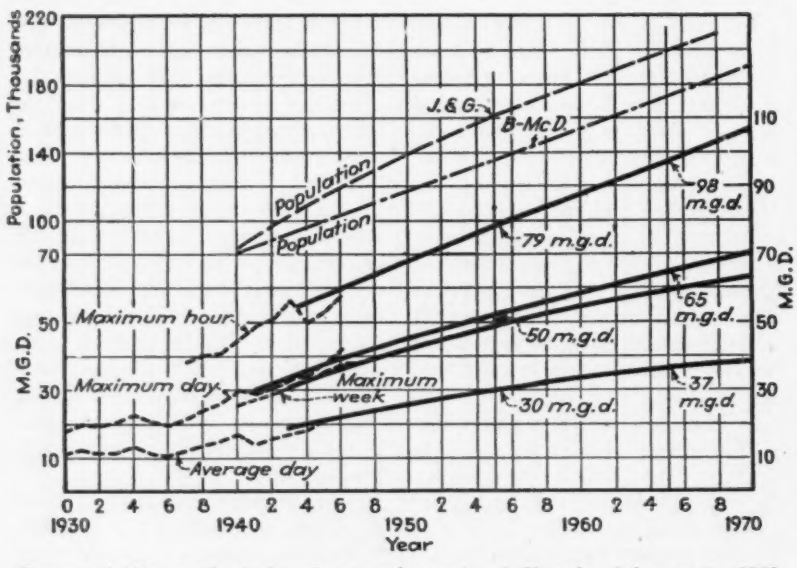
Booster pumps used

Increased capacity in the present 48-45 in. reinforced concrete pipe from the Verde River diversion point to the city reservoirs will total up to from 30 to 46 mgd. by the addition of booster pumps some 8 miles up the line from the existing reservoirs. As the estimated demand prior to 1955 will exceed 30 mgd. for less than 60 days per year, the boosted supply line is believed to be more economical than a separate, parallel pipe. The boosters will be remote-controlled from either the reservoirs or the Verde River intake station.

Other new facilities will include a 20-mgd. reservoir 8 miles east of Phoenix and a new 48-in. pipeline from this reservoir into the city. This addition to the existing supply line will deliver peak loads at the 79-mgd. rate with minimum pressures of 50 psi. downtown and 40 psi. in the residential area.

While the present bond issue covers only the increases expected up to 1955, estimates have been made for additions to be put in at that time sufficient to meet the supply for another 10 years, namely, to 1965. This second part of the program is estimated to cost, at present unit prices, about $1,400,000 and will produce an additional 15 mgd. from deep wells some 10 miles east of Phoenix, paralleling existing supply lines with a new 54-in. main and constructing a downtown reservoir or reservoirs. With these changes the capacity of the system will be increased, in 1965, from 50 to 65 mgd. and the peak hour capacity will be raised from 79 to 98 mgd. For these second stage increases the estimated costs to meet all demands expected up to 1965 are figured as totaling $7,400,000.

In laying out plans for these increased water supply facilities, studies have been made by three local engineering firms: Yost & Gardener, Johannessen & Girand and the firm of Headman, Ferguson & Carollo. A report on the water system prepared by Burns & McDonnell Engineering Co., Kansas City, was used in the studies. The spillway gates for the Horseshoe Dam are to be designed by Leeds, Hill and Jewett, Los Angeles. Gail Baker is city engineer of Phoenix.



Curves plotting estimated water requirements at Phoenix, Ariz., up to 1970.

Pollution Control Aided by Waste Recovery

Treatment of waste from the manufacture of industrial solvents utilizing corn and molasses and now discharged into the river by the Commercial Solvents Corp. of Peoria, Ill., will produce valuable livestock feed. Removal of pollutional materials from the river equivalent to domestic sewage from a city of about 350,000 people is an important factor in this program. The project is the final step in a stream pollution abatement program started by the corporation in 1938 with the construction of a recovery plant for a portion of this process waste—at that time estimated as equivalent to a domestic sewage load from 138,000 persons.

Working together on this program with the corporation was the Greater Peoria Sanitary District and the Illinois State Sanitary Water Board.

Commenting on this achievement, C. W. Klassen, technical secretary of the board, stated, "While the abatement of stream pollution is our primary objective, promoting the recovery of by-products from waste material has been a definite part of the board's program, and action by this large corporation is illustrative of the excellent cooperation which has been received from Illinois industries."

Comment and Discussions

Readers' opinions on matters that concern engineers and contractors

AISC Specification Discussed

Sir: In the new specification for structural steel for buildings issued Feb., 1946, by the American Institute of Steel Construction (*ENR*, Oct. 17, vol. p. 529) we find certain statements and regulations that do not seem to be clear. For example, consider Section 15 (a) (3) on bending. Why have a fraction that is complicated to write? Why not use 12,000,000 (bt/ld) instead?

Using the relation $ld/bt = 600$, we can find the limiting span length of a beam. For instance, for a 14-in. WF 370-lb. beam, with $d = 17.94$, $b = 16.48$ and $t = 2.66$, we find the span, l, to be 122 ft. Should we now have a similar beam, with $t = 2 \times 2.66$, then $l = 244$ ft., and should we take a 14-in. WF 30-lb. beam, then l becomes 9.3 ft. It is obvious that this new formula needs to be revised.

With respect to deflection and unit-stress relationships in Section 17(a), it should be noted that the deflection, D, of a beam subject to uniform loading is $30fl^2/Ed$. So, with $f = 20{,}000$ psi., $E = 29{,}000{,}000$ psi., and $d = l/24$, we find that $D = l/290$. This deflection remains constant when the fiber stress is lowered in proportion to the increase of the ratio l/d, as stated in the rule given under 17(a). Thus, if a 12-in. WF beam is used for a span of 24 ft., a fiber stress of 20,000 psi. is allowed and if the same beam is used for a span of 32 ft., the allowable fiber stress will be $20{,}000 \times 20/32 = 12{,}500$ psi., but the deflection will still be 1/290 of the span in both cases. Substituting $l/360$ for D, we find $f = 16{,}100$ psi. This means that, for uniform loading, it is impossible to use a stress of 20,000 psi. if the deflection shall be kept less than $l/360$ of the span.

Suppose we have a 14-in. WF 30-lb. beam loaded over a span of 34 ft. What fiber stress should be used? The maximum span for loading using 20,000 psi. is found to be 9.3 ft.; so the allowable fiber stress becomes $20{,}000 \times 9.3/24 = 5{,}460$ psi. The stress determined by deflection is 20,000 up to 28 ft., and becomes in this case, if the beam is braced, $20{,}000 \times 28/34 = 16{,}450$ psi. If the beam is not braced laterally, do we use a stress of 5,640 psi. or $5{,}640 \times 28/34 = 4{,}640$ psi.?

ODD ALBERT
Belmar, N. J.

Sir: In the Fifth Edition of the AISC Manual, the value d/bt is given for each beam shape at the top of the beam tables, p. 175 to 195, inclusive. In this form these values can be applied to a given problem, involving a particular span length, by direct multiplication, rather than by division, as would have been the case had the reciprocal of the value been listed. This consideration, together with the fact that long usage had given the expression l/b (as distinguished from b/l) a widely accepted meaning, may have been responsible for the choice of the former. It is the writer's feeling that designers, using the recommendation in their daily work will find the former quite as convenient as the latter; if not, the conversion is so simple that it can be made almost without thinking.

The figures which Mr. Albert gives with respect to a 14-in. WF 370-lb. shape used as a beam, which figures lead him to the conclusion that the formula obviously needs to be revised, constitute an extrapolation not intended by the author of the recommended provisions for laterally unsupported beams, and one which serves no useful purpose. Just as there is a range of short spans where the formula has no application because the condition of elastic instability is never present, so too there are controlling conditions at the other extreme of spans, which place limits beyond which the formula need have no significance.

The graphical presentation of the formula, as applied to shapes that are likely to be used as beams, given on p. 203-206 of the new manual, is based on the practical consideration that there will be no occasion to use a shape on spans so long that more than a quarter of its strength is required to carry its own weight. Similar reasoning would limit the 14-in. WF 370-lb. beam to a span something under 74 ft., assuming, of course, that some compelling reason existed for the use of such an inefficient beam shape, and provided that a deflection ranging upward to 6¼ inches, would be acceptable. For the same reason, even less significance need be attached to the use of the formula in connection with a shape modified as suggested.

Use of the words "if practicable" gives the provisions of Section 17(a) the status of guides to good design rather than of inflexible regulations. As such, they are an extremely simple means of assuring satisfactory yet economical results. The basis for the first quoted provision is apparent from the equation for D. If the depth, d, of a uniformly loaded beam is to be decreased from some generally acceptable figure, the fiber stress, f, must be reduced in the same proportion in order to maintain the same deflection.

Mr. Albert's conclusion that it is impossible to use a stress of 20,000 psi. and keep the deflection of a uniformly loaded simple beam less than 1/360 of the span needs further qualification. The 1/360 limitation is concerned only with deflections resulting from *live* loading, since this is the only loading which can adversely affect the plaster ceiling (substantially all of the dead load having been imposed before the plaster sets). His limiting stress of 16,000 psi., therefore, applies only to the live loading. Only when the live load exceeded 16/20 of the total load would the rule of 1/360 operate to limit the allowable total unit stress to something below 20,000. Such a proportion of live to dead load is by no means the common condition.

The answer to the question of allowable working stress for the laterally unsupported 14-in. WF 30-lb. beam on a 34-ft. span may be found in the earlier discussion of the provisions of Section 17 (a). Under these provisions it is recommended that, in order to keep deflection within generally acceptable limits, the working stress, in this example, be limited to something less than 16,450 psi. Because of the

condition of lateral support, it is required that the working stress be limited to, not 16,450, but 5,460 psi. This more drastic limitation will of course result in a deflection much less than that implied as a maximum in Section 17 (a). No useful purpose will be served in further reducing it by 28/34.

T. R. HIGGINS
Director of Engineering
American Institute of Steel Construction, New York, 17, N. Y.

School Barracks by FPHA

In the news article "Barracks Go To School To Ease House Shortage" (*ENR* Oct. 24, 1946, vol. p. 553) there was an erroneous reference to the Federal Works Agency as "the source of barracks . . . and surplus materials . . . for reerection and use by married students."

It is the Federal Public Housing Authority, through Congressional appropriation of funds by the Mead-Lanham Legislation, that is authorized to provide temporary emergency housing for veterans. The Federal Works Agency supplies colleges and educational institutions with non-dwelling facilities for classrooms, laboratories, classroom furniture and cafeterias.

JOHN A. KERVICK
Director, Region II, FPHA
New York City

Shoehorn Fit for Sewer

Sir: Not the least of the problems encountered in recent relocation of a 24-in. storm sewer at Gainesville was to find a place to put it.

The accompanying photograph of a 300-ft. length of ditch shows 35 existing pipes and cables ranging from 3 to 14 in. in diameter. This relocation is being made alongside a new turbine room at our new municipal light plant and due to local conditions, was the only possible alignment to use, since the new building will be on one side and a paralleling 10-in. water main is on the other. In addition to the difficult situation pictured, there is a 10-in. parallel water main on the very edge of the ditch and a 6-in. sanitary sewer line which also parallels the center line of the ditch just below grade.

Despite the fact that plans were available on all existing installations, it was not felt safe to lay any pipe

Puzzle picture. Find a place to fit a 24-in. storm sewer.

until the entire excavation was completed and obstructions uncovered, after which it was finally determined that the new 24-in. sewer could be installed with a clearance of exactly 0.1 ft.!

R. T. CUNNINGHAM
City Engineer
Gainesville, Fla.

Connecticut Out in Front

Sir: The article "Where We Stand on Pollution Control" (*ENR* Dec. 26, 1946 vol. p. 886) outlines the history of the establishment of state sanitary water boards, listing the Pennsylvania board created in 1923 with very limited jurisdiction, and those created in Wisconsin in 1927 and in Illinois, Michigan and Tennessee in 1929.

The Connecticut State Water Commission was created by the General Assembly in 1925 and was given authority to abate pollution of all the waterways of the state by sewage, industrial wastes or anything else which might make the water unclean or impure. The Connecticut act was patterned somewhat after a law then in existence in Rhode Island but which subsequently was repealed by that state.

Connecticut has many thickly settled urban areas. The state is heavily industrialized and the variety of manufacturing is great. Many of our factories are old. Their location in relation to a stream or harbor, the extent to which other buildings hedged them in long ago, and their internal piping, etc., all help to make the waste treatment problem difficult.

As reported in your article, Connecticut is a member of the Interstate Sanitation Commission. The director of the commission is ex-officio a member of that commission and our experience includes that acquired during the writing and the operation of the first interstate compact for the control of pollution.

I believe that the Connecticut State Water Commission has had a longer and more extensive experience with a comprehensive pollution control program than any other agency in the United States, federal, state or local.

RICHARD MARTIN
Director, State Water Commission
Hartford, Conn.

(Editor's Note—Our article, as stated in the first paragraph, was an extract of a report made by a committee of The American Public Health Association. Mr. Martin's statement has been referred to that committee.)

Sponsors for Research Project

Sir: I notice an error in your issue of Dec. 19, 1946, that I think should be corrected.

On vol. p. 837, center column, second full paragraph, the statement concerning the research project in the Hybla Valley, Va., should read: "It is being sponsored by the Highway Research Board, the Public Roads Administration and *The Asphalt Institute*". The U. S. Army Engineers are not connected with this project.

ROY W. CRUM,
Director, Highway Research Board

No Such Border

Kittery, Maine, is on the Maine New Hampshire border, not the "Maine-Massachusetts" border as stated on vol. p. 148 of the Jan. 23 issue of *ENR*. This error was not in Mr. Needles' original manuscript. It was made by one of the editors in an attempt to indicate the locations of Kittery and Fort Kent, the towns given by Mr. Needles as the terminals of the Maine Turnpike. The same error was repeated in Fig. 2. And the printer added to our embarrassment by dropping off the last line of the article, which should have said that B. Perini & Sons is the contractor on all 44 miles of paving on the turnpike —EDITORS.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

About Unionization

UNIONIZATION OF PROFESSIONAL ENGINEERS AND CHEMISTS—By Herbert R. Northrup. 50 pp. Industrial Relations Counselors, Inc., Rockefeller Center, New York. $1.50.

This 50-page pamphlet should be read by all interested in the question of the possible effect of the union movement upon the engineering profession, and especially by those who now are considering amendments to the Wagner Act to protect the interests of professional men. The author, who has long been a student of industrial relations, came to his task with none of the preconceived ideas with which most engineers approach this question. The result is a dispassionate and enlightening review of developments up to the middle of 1946.

Outstanding is Mr. Northrup's conclusion that under the Wagner Act as now written the National Labor Relations Board ordinarily excludes professional employees from bargaining units composed primarily of production and maintenance employees except when they are performing work of non-professional character. He holds that the proposals for amending the Wagner Act put forward by engineering organizations are unrealistic.

Precast Concrete Practices

STRUCTURAL PRECAST REINFORCED CONCRETE—By Kurt Billig. 91 pp. Cement and Concrete Association, 52 Grosvenor Gardens, London, S.W. 1, 10s. 6d. Obtainable through the Holliday Bookshop, 49 E. 49th St. New York.

Fully aware of the disadvantages of precast concrete as well as the numerous advantages, the author reviews present European practices in this type of construction and gives general information on the design of various systems. Some indication of the broad coverage of the subject is given by the chapter titles: general data; floors; beam joints; socket foundations; joints between columns; industrial buildings and sheds; multistory buildings and flats; stairs; dwelling homes; huts; structures on railways; pipes, poles and piles; agricultural structures; bridges, arches and roof trusses; water works; ships and floating structures; blocks and slabs; various applications; forms; treatment of concrete; and prestressed products.

Quality Control

STATISTICAL QUALITY CONTROL—By Eugene L. Grant. 563 pp. McGraw-Hill Book Co., New York 18 and London. $5.

Quality control of manufacturing activities by statistical methods has been developed over a period of years in certain industries which involve repetitive processes. During the war, to save time and material, more extensive industrial use was made of these methods, but no authoritative text was available.

Intended for use as a working handbook for those who apply such quality control, no attempt is made in the book to go into statistical theory. However, enough in the way of basic statistics is given so the tool described can be readily understood and applied.

Application of these methods to civil engineering and construction is limited. They may be of use in research and testing laboratories, equipment manufacturing, and in mass prefabricated construction.

Steel Supports in Tunnels

ROCK TUNNELING WITH STEEL SUPPORTS—By R. V. Proctor and T. L. White, with an introduction to Tunnel Geology by Karl Terzaghi. 271 pp. The Commercial Shearing & Stamping Co., Youngstown, Ohio. $2.50.

Although this book has been published by the manufacturer of special types of steel plates used in tunneling, that fact in no way detracts from its value as a text on one of the important aspects of tunnel driving. The book contains a great deal of practical information on the general principles involved in supporting the roofs of tunnels, with specific examples of the use of steel ribs and lagging.

Section I, Rock Defects and Loads on Tunnel Supports, which was written by Karl Terzaghi, makes up about one third of the book. It discusses the geological conditions commonly met in tunnel driving.

Mathematics of Statistics

MATHEMATICAL METHODS OF STATISTICS—By Harald Cramer, 575 pp., Princeton University Press, 1946, Princeton, N. J $6.

First published in Sweden in 1945 by Almquist & Wilksells, this volume by Harald Cramer, Professor in the University of Stockholm, covers the higher mathematics of probability, applied to statistics. A good working knowledge of mathematics through differential and integral calculus is a prerequisite for a full understanding of this exposition of the mathematical theory of modern statistical methods.

The first section stresses fundamental concepts of a distribution and of the integration with respect to distribution. The second section deals with the general theory of random variables and probability distributions, and the third with the theory of sampling distributions, statistical estimation, and tests of significance.

Founded on the author's university lectures since 1930 and through 1944, the purpose of this work is to join the lines of development of methods by British and American statisticians with the calculus of probability, as pure mathematical theory developed by French and Russian mathematicians.

RUDIMENTARY MATHEMATICS FOR ECONOMISTS AND STATISTICIANS—By W. L. Crum and Joseph A. Schumpeter, 183 pp., McGraw-Hill Book Co., New York and London. $2.50.

First issued as a supplement to The Quarterly Journal of Economics in March, 1938, this volume by W. L. Crum and Joseph A. Schumpeter, professor of economics, Harvard University, is just what its title implies. Engineers, grounded in mathematics and the handling of empirical data, will find it too elementary to

be of value to them unless they have a job of training someone not so grounded, in which case it should be a great time and effort saver. It selects from algebra, trigonometry, analytic geometry and differential equations, those processes needed for analyzing volume and price data, shows how to set up equations and construct curves or charts to represent them. It covers treatment of limits, rates and derivatives, location of maxima and minima and formulation and solution of simple problems by differential equations.

Inside a Great Terminal

GRAND CENTRAL—By David Marshall. 280 pp. Whittlesey House, McGraw-Hill Book Co., New York 18, N. Y. $3.50.

Engineers are prone to complain that their fellows do not get adequate credit for their share of the work on big operations in descriptions of such projects prepared for public consumption. That criticism cannot be made of this unusual account of the Grand Central Terminal in New York and its daily operations. Two chapters are devoted to William J. Wilgus and his plans for building the present terminal while keeping the old one in operation. The architects also come in for comment, but some of it is too complimentary to Whitney Warren, who is generally credited with having designed the architectural elements of the present structure.

This book is not an engineering text, but that fact adds rather than detracts from its interest as an account of a great railroad terminal in which so much engineering was involved.

Clay Pipe Manual

CLAY PIPE ENGINEERING MANUAL—159 pp. Clay Sewer Pipe Association, Columbus, Ohio. $3.

Municipal engineers will be interested in this small but comprehensive volume that covers effectively all phases of the use of clay pipe. Such a compilation of data has long been needed and fills a special niche in the engineer's library.

Design procedures for both sanitary sewers and storm water sewers are fully explained and supported by ample hydraulic data to render easy the solution of most problems. The chapter on pipe strength and trench loads with its many tabulations will be particularly helpful to the designer in selecting pipe for a specific condition. Various methods of laying pipe and building appurtenances are presented effectively. Included also are specifications and listings of the various sizes and strengths of clay pipe. Consideration is given to the utilization of clay pipes in the design of under-drainage structures for highways and airports.

This manual is profusely illustrated and contains innumerable illustrations and graphs which taken together provide a readily accessible and compact reference for busy engineers.

Miscellaneous Notes on Booklets and Reprints

A NEW JOURNAL relating to traffic control bearing the title "Traffic Quarterly" has been inaugurated by the Eno Foundation for Highway Traffic Control, Saugatuck, Conn. The first issue, dated January, 1947, is made up chiefly or articles relating to parking.

BUILDING CODE REQUIREMENTS for dwellings are given in "Building Code Requirements for New Dwelling Construction", Building Materials and Structures Report BMS 107, which is for sale at 20c. by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. The code is of performance-standards type, with basic standards modified where specialized experience in housing is indicated. It was prepared by the National Bureau of Standards with the cooperation of the National Housing Agency.

A PAMPHLET designed to stimulate local interest in the projected National System of Interstate Highways has been issued by the Automotive Safety Foundation (Hill Building, Washington 6, D. C.) as bulletin No. 14. Creation of such a system was authorized in the Federal Aid Highway Act of 1944. It is to be approximately 40,000 miles in extent and will be made up of reconstructed sections of existing highways or by new highways where existing routes are inadequate.

A SUMMARY of a paper on dam design originally published in Spanish in 1944, has been published in English by the author, Eugenio Diaz del Castillo, (130 Morningside Drive, New York 27, N. Y.) under the title "Solid and Buttress Dams with Stabilizing Sloping Base." The pamphlet describes what is characterized as "A new general method for the design of dams," on which a patent recently was issued to the author in this country.

THE OCT. 3, 1946, issue of *ENR* contained a notice of publication of "English-Spanish Dictionary of Engineering Terms." No price was given. We have now been advised that copies can be obtained for $2 in U. S. currency from the Sociedad Cubana de Ingenieros, Avenida de Belgica No. 258, Havana.

New Engineering Books

ADVANCED MATHEMATICS FOR ENGINEERS, Second Edition—By H. W. Reddick and F. H. Miller. 508 pp. John Wiley & Sons, New York. Chapman and Hall, London. $5.

RADIANT HEATING—By T. Napier Adlam. 472 pp. The Industrial Press, 148 Lafayette St., New York 13, N. Y. $6.

MR. BLANDINGS BUILDS HIS DREAM HOUSE—By Eric Hodgins. 237 pp. Simon and Schuster, Inc., New York 20, N. Y. $2.75.

SAUDI ARABIA—By K. S. Twitchell. 192 pp. Princeton University Press, Princeton, N. J. $2.50.

APPLIED ATOMIC POWER—By E. S. C. Smith, A. H. Fox, R. T. Sawyer and H. R. Austin. 227 pp. Prentice-Hall, Inc., New York 11, N. Y. $4.00.

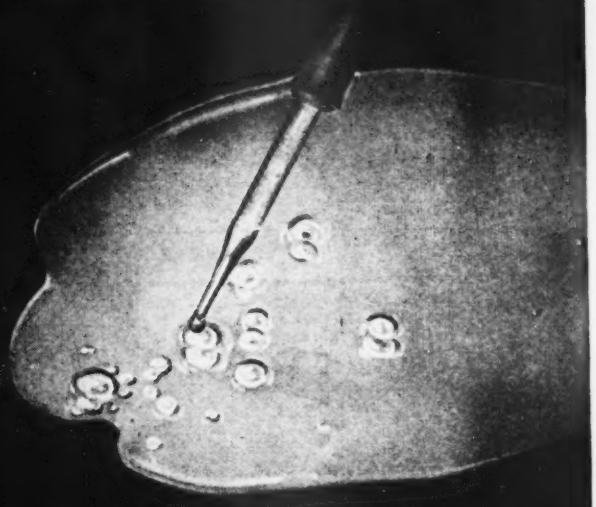
THE FUTURE OF HOUSING—By Charles Abrams. 428 pp. Harper and Brothers, New York 16, N. Y. $5.

SCIENCE, ITS EFFECT ON INDUSTRY, POLITICS, WAR, EDUCATION, RELIGION AND LEADERSHIP—By D. W. Hill. 114 pp. Chemical Publishing Co., Brooklyn 2, N. Y. $2.75.

DDT AND THE INSECT PROBLEM—By J. C. Leary, W. I. Fishbein and L. C. Salter. 176 pp. McGraw-Hill Book Co., New York and London. $2.50.

(*Continued on page* 123)

FROM OILS THAT CAN'T "STAND" WATER



TO OILS THAT MIX WITH IT

It is a fact that certain Shell lubricating oils separate themselves from water as though it had the plague . . . and that other oils "join up" to make remarkably stable emulsions.

It is also a fact that emulsibility is just one of the many vital factors a Shell Lubrication Engineer takes into account when he selects proper lubricants for your equipment. His stock in trade is a lubricant to meet your every need . . . his function is to select the right one for each job.

From his experience, the Shell Lubrication Engineer can help you when something's wrong and needs quick attention—and he can help prevent trouble by analyzing your equipment right now to see that you are getting the benefit of all that's new in lubrication.

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MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

The major price increases this month occurred in steel products. The base mill price of STRUCTURAL STEEL increased from $2.35 to $2.50. Warehouse structural steel price gains, ranging from $.15 to $.75 per 100 lb., occurred in Chicago, Dallas, Denver, Detroit, Pittsburgh, and San Francisco. REINFORCING BARS increased $.10 to $.45 per 100 lb. in Pittsburgh, Philadelphia, Detroit, and Dallas. EXPANDED METAL LATH rose $1.50 per 100 sq. yd. in Chicago, Cleveland, and Minneapolis. WELDED FABRIC REINFORCING, 4x6 in., rose $.07 per 100 sq. ft.; 4x12 in. rose $.05; and 6x6 in. rose $.07.

Increases this month reflect not only higher prices of construction materials, but also increased freight rates. WHITE LEAD prices rose $.50 per 100 lb. this month, and RED LEAD $1.25. LUMBER, 2x4, increased $9.50 per M ft. b.m. in Chicago. Most WAGE gains occurred in the skilled trades. Bricklayers' rates rose $.25 in St. Louis and San Francisco, and $.35 in Baltimore. Structural ironworkers' rates rose $.125 in Atlanta and $.25 in New York. Carpenters' rates rose $.40 in New York. The ENR 20-cities skilled average rose $.034, and the common average $.014.

CEMENT, AGGREGATE, READY-MIXED CONCRETE—F. O. B. CITY

	PORTLAND CEMENT (Per bbl., C/L lots incl. 40c per bbl. for bags, cash dis. not deducted)			SAND AND GRAVEL (Per ton, carload lots)			CRUSHED STONE (Per ton, carload lots)		CRUSHED SLAG (Per ton, carload lots, f.o.b. plant)		CONCRETE BLOCK 8x8x16-in.: truckload del.: per block		READY CONCRETE Mixed 1:2:4, cu.yd.
	Cloth	Paper	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand grav.	Lt.wgt. Agg.	50 c.y. del.
Atlanta	$2.77	$2.52	$2.43	$1.79	$1.89	$1.65	$1.79	$1.89	$1.59	$1.69	$0.17	....	
Baltimore	2.80*a*	2.55*a*	2.30*a*	2.10‡	2.10‡	1.60‡	2.00‡	2.00‡	2.00‡	2.00‡	.145	$0.145*w*	$8.00
Birmingham	3.65	2.80	....	2.06	2.06	1.63	2.50	2.50	1.00	1.20	.1425	.1425	6.90
Boston	3.70*bgg*	2.85*b*	2.60	1.50‡	1.50‡	1.40‡	1.25	1.35	....	....	.13	.155*w*	7.90*m*
Chicago	3.65	2.80	2.65	2.675‡*d*	2.675‡*d*	2.725‡*d*	2.45‡*d*	2.45‡*d*	2.00‡	2.00‡	.195	.195*x*	....
Cincinnati	....	....	....	....	....	....	....	....	....	....	....	....	....
Cleveland	3.32	2.47	2.22	2.50‡	2.50‡	2.55‡	3.30‡	3.20‡	....	....	....	19	9.63
Dallas	3.31	2.46	2.21	1.80	1.80	1.60	1.89	1.99	....	....	.0775*p*	....	8.68
Denver	3.74	2.94	2.69	1.85	2.00	1.15	....	....	....	....	....	.2175*w*	....
Detroit	3.28	2.43	2.23	2.75	2.75	2.50	2.50	2.50	2.25‡	2.25‡	.16	.17*w*	7.85
Kansas City	3.00	3.00	....	2.00	....	1.40	2.00	2.00	....	....	.16	.16*wy*	8.50*n*
Los Angeles	3.60*rjj*	2.90*r*	....	1.55	1.55	1.40	1.40*f*	1.40*f*	1.40*f*	1.40*f*	.125*bb*	.146*b*	8.75*m*
Minneapolis	4.15*dd*‡*gg*	3.90*dd*‡	....	1.25*h*	1.25*h*	.45*h*	1.25*h*	1.25*h*	....	....	.183*ff*	....	8.80*kk*
Montreal	....	1.95*r*	1.80*r*	1.65‡*s*	1.65‡*s*	1.10*t*	.95*ct*	1.05*ct*	....	....	.1391	.1515	7.75*s*
New Orleans	2.41	2.16	1.92	1.67	1.65	1.21	....	....	.90	1.15	.23	....	9.25
New York	4.16‡*gg*	3.16‡	....	1.80*deu*	1.80*deu*	1.15*eee*	1.90*ds*	1.90*ds*	....	....	.17*ii*	.18*eeii*	8.95*kq*
Philadelphia	2.75	2.50‡	2.30‡	1.55‡	1.65‡	1.20‡	1.90‡	1.95‡	1.25	1.25	.155	.155*w*	8.55
Pittsburgh	2.80	2.55	2.35	1.85‡	1.85‡	2.15‡	2.35‡	2.35‡	1.80	1.80	.21*z*	.21*z*	9.35
St. Louis	3.06*o*	3.08*o*	....	2.10‡*o*	2.10‡*o*	2.10‡*o*	1.25/1.95	1.25/1.95	....	....	.175	.22*yo*	9.45
San Francisco	3.54	2.64	2.24	1.46	1.46	1.56	1.56	....	....	....	....	.25*y*	9.60
Seattle	....	2.99*o*	....	2.35‡*t*	2.35‡*t*	2.35‡*t*	2.85‡*od*	2.85‡*od*	....	....	.17	....	8.25

‡ Delivered. *a* 10c. allowed for each returnable bag. *b* 10c. per bbl. off for cash. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount of 2 percent for cash in 10 days. *l* 2000 lb. concrete. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 5½ x 8 x 12 in. *q* 5 cu. yds. or more. *r* 10c. per bbl. off cash 20 days. *s* 8% sales tax included. *t* 8% sales tax not included. *u* In outlying New York districts, price is $1.80. *v* 20c. per bbl. discount; 80c. per bbl. for bags. *w* Cinder. *x* Waylite. *y* Haydite. *z* Celocrete. *aa* Pumice. *bb* 4 x 8 x 12 in. *cc* Also 8 x 18 in. *dd* Prices quoted are LCL. Carload lots not available. *ee* In outlying New York districts, price is $1.22. *ff* 8 x 8 x 18 in. *gg* $1.00 per bbl. refund for return of bags. *ii* Yard price. *kk* 2500 lb. compression strength. *jj* 80¢ per bbl. refund for bags.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount. 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICE BASES AT CEMENT MILL

Charge for bags not included. For cloth bags, add $1.05c. per bbl.; 25c. refund allowed for each returnable bag; for paper bags add 20c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$1.90	$1.85	Ironton, Ohio	$1.80*	$1.75*	Universal, Pa.	$1.85	$1.80
Hannibal, Mo.	1.90	1.85	Northampton, Pa.	1.75	1.70	Waco, Tex. (Plus 9c. tax in Tex.)	1.75	1.70
Independence, Kans.	1.90	1.85	Richard City, Tenn.	2.05*a*	1.95	Montreal City (Discount 10c per bbl. 20 days)	1.68	1.68
			Steelton, Minn.	2.00	1.95			

* Destination price base effective Sept. 17, 1945
a For cloth bags, add $1.00.

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS—F. O. B. CITY

	PAVING BRICK AND BLOCK			PAVING ASPHALT (Per ton, less than 80 penetration)		ASPHALT BINDERS—FLUXES (Per gal., 80-300 penetration)		CUTBACK ASPHALT (Per ton)		ROAD OIL (Per gal.)	ASPHALT EMULSION (Quick-breaking) Per gal	
	Granite per M lots of 50,000 4x4x8 in.	Brick per M 3x4x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	$35.00	$2.25	$14.00	.....	$0.074	.....	$0.0806*h*	.....	$0.0781	$0.0806	.....
Baltimore	150.00‡	52.70	85.00*m*	15.00*r*	21.00*r*	.06*r*	0.09*r*	13.00*r*	23.00*r*	.06*r*	.07*r*	.14*r*
Birmingham	.....	32.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Boston	85.00	59.00	3.75	16.00	25.00	.0675	.12	18.00	31.00	.0675	.0875	.15
Chicago	150.00‡	65.00/68.00*e*‡	2.97/4.10*d*‡	16.50*b*	24.00*b*	15.50*bg*	23.00*bg*	.07/.0725*hh*	.16/.1625*hh*	.0525/.0575*b*	.0925/.1025*b*	.135/.155*b*
Cincinnati	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cleveland	150.00	49.00*i*	3.81	18.00	26.00	17.00*g*	25.00*g*	.08*h*	.16*h*	.075	.10	.18
Dallas	.....	40.00	.....	16.95	29.15	.0686	.1225	20.00	37.60	.06	.0725	.135
Denver	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Detroit	.....	75.00*i*	.....	17.60*f*	26.50*f*	.0734	.128	.0718*h*	.119*h*	.067	.0974	.133
Kansas City	.....	45.00	.....	15.00*u*	20.60*u*	16.60*g*	.....	.07*h*	.0765*hu*	.....	.11	.15*u*
Los Angeles	.....	60.00	.....	9.00*b*	23.00*b*	9.50*bg*	24.00*bg*	9.50*bg*	.....	.035	.085	.16*b*
Minneapolis	.....	.....	2.39*d*	.....	.....	.....	.....	.....	.....	.....	.....	.....
Montreal	100.00	.....	.....	16.60*k*	24.25*k*	.1160*k*	.1485*k*	.115*hk*	.135*hk*	.084*k*	.135*k*	.188*k*
New Orleans	.....	.....	.....	13.00*a*	.....*s*	12.50*g*	.....*s*	6.50	.....*s*	.055	.08	.13
New York	.....	.....	2.75*n*	20.68	32.85*s*	19.68*g*	38.68*g*	.0857*h*	.1609*h*	.0807	.0855	.1643
Philadelphia	150.00	62.00	4.06	19.00	.....	17.00	.....	.08*h*	.....	.....	14.00*gr*	.....
Pittsburgh	135.00	39.75	3.90	19.00	27.00	.095	.185	22.00	34.00	.075	.085	.15
St. Louis	.....	42.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Francisco	.....	47.75*c*	.....	11.75	21.00	11.75*g*	.....	13.75	.....	.....	.0525	.1125*k*
Seattle	.....	.....	.....	11.75*i*	22.75*i*	9.50	.....	11.75*i*	14.75	10.90*i*	.0525*i*	.0625

‡ Delivered *a* F.o.b. Baton Rouge. *b* F.o.b. Refinery. *c* 2½ x 8½ x 4 in. *d* 2-in. interior block, 6-lb. treatment. *e* 3½ x 4 x 8½. *f* Mexican. *g* Per ton. *h* Per gallon *i* F.o.b. Martinez. *j* 3 x 3½ x 8½ in. *k* Tax included. *l* Quoted on request only. *m* Per thousand. *n* 2 in., treatment 6 lb. *r* February 1943 prices, none later available. *s* Drums not available. *t* Truck deliveries in Greater Cleveland.

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF. BARS ¼-in. billet *b*	RIVETS ½-in. structural	WIRE NAILS Base	SHEET PILING Base	STEEL RAILS Per Net Ton Standard	STEEL RAILS Per Net Ton Light	STEEL RAILS Per Net Ton Re-rolled	TRACK SUPPLIES Angle Bars	TRACK SUPPLIES Std Spikes *c*	TRACK SUPPLIES Tie Plates *c*	TRACK SUPPLIES Track Bolts
Birmingham	$2.50	$2.45	$5.25	$3.75/4.50	....	$50.00	$57.00	Not	$3.00	$3.65/4.50	$2.80	$6.50
Chicago	2.50	2.45	5.25	3.75/4.50	$2.65	50.00	57.00	avail-	3.00	3.65/4.50	2.80	6.50
Pittsburgh	2.50	2.45	5.25	3.75/4.50	2.65	50.00	57.50‡	able	3.00	3.65/4.50	2.80	6.50
Buffalo	2.50	2.45	....	....	2.65	.....	.....	.....	....	....	2.80	....
Cleveland	....	2.45	5.25	3.75/4.50	....	.....	.....	.....	....	....	....	....
Youngstown	....	2.45	....	....	....	.....	.....	.....	....	3.65/4.50	....	....
Detroit	....	2.585‡	....	....	....	.....	.....	.....	....	....	....	....
Gulf ports	2.735*a*	2.835*a*	....	.....	2.85*a*	.....	.....	.....	....	....	....	....
Pacific ports	3.035/3.41*a*	2.885*a*	....	4.285/5.035	3.235*a*	.....	.....	.....	....	....	2.80	....

‡ Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates alone. Steelton, Pa., on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per car.

IRON AND STEEL PRODUCTS—F. O. B. WAREHOUSE, PER 100 LBS., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS, Per 100 lb., ¼ in., base price 15 tons or over *b* New billet	REINFORCING BARS Rail steel	REINFORCING BARS Add Switch	REINFORCING BARS $/cwt. for Del.	EXPANDED METAL LATH Per 100 sq. yd., carload lots Std. diamond mesh, 3.4 lb	EXPANDED METAL LATH Std. ribbed 3.4 lb	WELDED FABRIC REINFORCING Per 100 sq. ft., carload lots 4x16 in., No 5 & 10 wires	WELDED FABRIC REINFORCING 4x12 in., No 8 & 12 wires	WELDED FABRIC REINFORCING 6x6 in. No. 6 & 6 wires Per 100 s. f.	SHEET PILING Per 100 lb. base price
Atlanta	$4.05‡	$4.12‡	$4.12‡	$.025	$.10	$23.16	$25.30	$2.00	$1.50	$2.12	$3.35
Baltimore	3.909	3.344	....	....	.10	24.50	26.50	1.88	1.42	2.00	3.25
Birmingham	2.35	2.35	2.35	.025	.10	36.00*p*	39.00*p*	1.98	1.49	2.10	....
Boston	4.162‡	4.194‡	2.97*c*	$20 C.L.	.10	18.50	20.50	1.94	1.46	2.05	3.02
Chicago	2.50*a*	2.45*a*	2.45*a*	.03	.05	24.00‡	26.00	1.85	1.40	1.96	3.00
Cincinnati	....	....	....	....	....	.....	.....	1.87	1.41	1.96	....
Cleveland	4.311	3.40	....	.025	.10	26.00	28.00	1.84	1.40	1.95	....
Dallas	6.00	5.00	5.00	....	....	31.00	35.00	2.11	1.57	2.22	....
Denver	5.50	4.77*o*	....	....	....	37.00	43.00*q*	2.15	1.60	2.28	....
Detroit	4.42‡	3.591‡	3.591‡	....	.10	38.00‡	42.00‡	1.86	1.41	1.97	3.31
Kansas City	4.44	2.75*cd*	2.75*cd*	.0	.05	29.50	31.50	1.96	1.48	2.08	3.0826
Los Angeles	5.20*f*	3.025	2.875	.03	.05	23.00	27.50	2.11	1.57	2.24	5.20
Minneapolis	4.142‡	2.99	2.99	.0	.10	26.50	28.50	1.98	1.49	2.10	3.47*d*
Montreal	4.55*i*	4.20*i*	4.20*i*	....	....	36.00*hi*	38.70*hi*	2.87	3.54*i*	2.96*im*	....
New Orleans	4.408‡	3.84	4.108	.05	.10	22.00	24.00	2.00	1.50	2.12	3.125
New York	4.17*r*	3.85*r*	....	....	.15	30.50*st*	32.505*st*	1.90	1.44	2.02	2.74
Philadelphia	3.97	4.24	....	....	....	20.50‡	22.50‡	1.89	1.43	2.00	3.41
Pittsburgh	2.50*a*	2.60*a*	2.60*a*	.025	.10	23.00	26.80	1.77	1.35	1.88	3.00
St Louis	3.40	3.49	3.49	.0	.05	34.00	36.00	1.87	1.42	1.97	....
San Francisco	4.90	3.06	2.875	.025	.10	28.00	31.50	2.11	1.57	2.24	4.50
Seattle	3.00*e*	3.00*e*	....	....	....	43.50	44.00	2.11	1.57	2.24	3.20*e*

‡ Delivered. *a* Mill prices. *b* 5–15 tons, add 15c. 1–5 tons, add 25c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b dock *f* Includes delivery in free delivery zone. *g* High scrap steel prices cut former 15c. differences between new billet and rail steel in many mills. *h* List price. *i* Plus Dominion and Province sales tax. *m* Per sq. yd. *n* Practically no carloads are available. Retail price delivered is $27.00 for std. diamond mesh and $29.00 for std. ribbed. *o* 20 tons and over. *p* Deliveries of 5000 sq. yd. or less. *q* ⅝ in. standard ribbed. *r* 5 tons or over. *s* LCL. *t* Asphalt and coated.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in. *a*	VITRIFIED SEWER PIPE Per foot, std. 8 in. s.s.	VITRIFIED SEWER PIPE Delivered std. 12 in s.s.	VITRIFIED SEWER PIPE ASTM 24 in.	VITRIFIED SEWER PIPE C13–35 36 in.	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in.	CLAY DRAIN TILE 8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM 12 in.	CONCRETE SEWER PIPE C 14–35 24 in.	WROUGHT STEEL PIPE (Full standard weight, f.o.b. destination *s*) 1 to 3 in., Butt Weld Black %	WROUGHT STEEL PIPE 1 to 3 in., Butt Weld Galv %	WROUGHT STEEL PIPE 3½ to 6 in., Lap Weld Black %	WROUGHT STEEL PIPE 3½ to 6 in., Lap Weld Galv %
Atlanta	$69.66	$0.43	$0.67	$3.39	....	$114.00	$140.00	$0.45	$2.00	53.2	40.2	50.7	37.2
Baltimore	74.20	.35	.60	2.70	$7.25	160.00	200.00	.85	2.25	56.9	43.9	54.4	40.9
Birmingham	65.00	.375	.675	3.06	....	210.00	350.00	.57 1.00	1.85/2.50	53.2	40.2	50.7	37.2
Boston	76.80	.392*m*	.756*m*	3.15*m*	7.995*m*	170.00‡*m*	265.00‡*m*	.53	2.04	55.2	42.2	52.7	39.2
Chicago	74.33	.49	.945	3.60	....	110.00‡	150.00‡	.65	2.25	59.0*t*	46.0*t*	55.5*t*	42.0*t*
Cincinnati	73.27	....	....	...	....	.....	.....	.54	2.00	57.4	44.4	54.9	41.4
Cleveland	74.75	.294	.567	2.565	6.8675	112.00*p*	176.00*p*	.58	2.25	59.65	46.65	57.15	43.65
Dallas	76.43	.375	.675	2.70	6.20	109.00	131.00	.45	1.45	51.3	38.3	48.8	35.3
Denver	81.56	.36	.648	2.70	....	154.00‡	295.00‡	.64	2.25	49.4	36.4	46.7	33.2
Detroit	74.75	.455	8.775	3.375	8.50*l*	170.00‡*m*	263.00‡	.40	1.45	57.9	44.9	55.4	41.9
Kansas City	75.73	.345	.625	2.47	6.85	173.00	312.00*m*	.45	1.60	54.7	41.7	51.8	38.3
Los Angeles	88.40	.414†	.745†	2.988	7.47	157.00	260.00	1.25	2.50	....	....	....	....
Minneapolis	77.83	.47†*o*	.90†*o*	3.65†*o*	....	.....	.....	.93	2.43	54.8	41.8	51.9	38.4
Montreal	78.20	.68	1.20	3.94	6.38*e*	.....	.....	72.00*jk*	218.00*jk*	....	....	....	....
New Orleans	71.78	.31	.558	3.558	....	112.00	.....	....	....	52.4	39.4	50.3	36.8
New York	73.60	.52	1.01	4.00	9.43	.....	.....	.60	1.40	56.2	43.2	53.7	40.2
Philadelphia	72.10	.50	.95	3.95	9.75	220.00	275.00	.90	2.75	56.7	43.7	54.2	40.7
Pittsburgh	75.18	.322†*m*	.631†*m*	2.70†*m*	6.625*m*	124.20	193.90	1.05	2.50*g*	60.0*t*	47.0*t*	57.5*t*	44.0*t*
St Louis	72.84	.351*n*	.632*n*	2.527*n*	5.60*n*	105.80	212.00	1.20*h*	2.55*i*	56.6	43.6	53.2	39.7
San Francisco	88.40	.4375*d*	.7875*d*	3.15	7.875	159.00	265.00	.65	2.70	....	....	....	....
Seattle	90.20	.4375*b*	.7875*b*	3.15	....	.....	.....	.55*f*	1.60*f*	....	....	....	....

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier, C/L lots, Burlington, N. J. (base) $70.00. Based on existing freight rates; subject to rate change. Gas pipe and class A, $5 per ton additional. 4 in., $5 per ton additional, 30 in. and larger, usually $1 per ton less. *b* Double strength. *d* List. *e* 30 in. *f* Less 5% for cash. *g* Culvert pipe *h* Reinforced; spec. C–76–37. *i* Reinforce, spec. C–75–41. *j* Centri-spun. *k* Per 100 feet. *m* Truck delivery. *n* Less 3% for cash. *o* Since carload lots are not available at this time, listed price is based on LCL (no minimum). *p* Price incorrectly quoted last month.

s Discounts from standard list consumers carload prices. Base price approx $200 per net ton. List prices per ft.: ¼ in., 8¼c.; ⅜ in., 11¼c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92; 3 percent tax on transportation costs not included. *t* Within switching limits. WROUGHT IRON PIPE: List prices per ft. same as wrought steel pipe. Discount for Pittsburgh base. Buttweld — 1 in. and 1¼ in. black, 34, galv., 16; 1½ in. black, 38, galv., 18½; 2 in. black, 37½, galv., 18. Lapweld — 2½ in. to 3½ in. black, 31½, galv., 14½; 4½ in. to 8 in. black, 32½, galv., 17. Freight rates to destination to be added to name delivered price.

"PLUG-WELDING" MAKES THIS A BETTER DIPPER

- Plug Welded—improved design
- All Manganese Steel Construction—long service life
- Streamlined—easier penetration, loading, dumping
- Lighter Weight—heavier payloads

AMSCO DIPPER DESIGN PERMITS STRONGER CONSTRUCTION

Patented inter-locking design of Amsco Plug-Welded, All-Manganese Steel Dippers provides for stress-resistant welds . . . eliminates jutting shoulders that offer resistance to penetration, loading, and dumping.

Plugs in one casting fit into sockets in overlapping casting—see Figure 1. Overlapping portions are rabbetted for interengagement—see Figure 2. In both cases groove is formed for receiving weld deposit.

Additional features of Amsco Plug-Welded Dippers include: clean cutting teeth—rigidly locked in place, easily replaced; correctly contoured lip—shaped for easy penetration, full loading; flared body—tapers out slightly to door for positive, complete discharge of material.

MADE OF "THE TOUGHEST STEEL KNOWN"

The use of manganese steel throughout, plus this new all-welded design, assures the maximum in durability for a light-weight dipper.

Impact that fractures other metals work-hardens the surface of manganese steel without affecting toughness of the body metal. The surface of "the toughest steel known" takes on a "plow-share" polish that resists abrasion and assures smoother penetration and clean dumping.

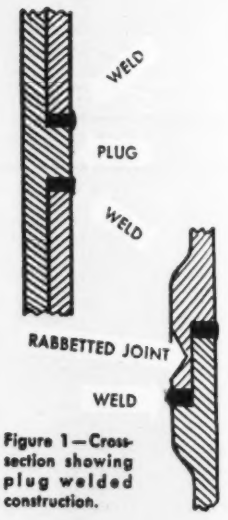


Figure 1—Cross-section showing plug welded construction.

Figure 2—Cross-section showing rabbetted overlap.

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
CHICAGO HEIGHTS, ILL.

Foundries at Chicago Heights, Ill., New Castle, Del., Denver, Colo., Oakland, Calif., Los Angeles, Calif., St. Louis, Mo.
Offices in principal cities. In Canada: Joliette Steel Limited, Joliette, Que.

LUMBER, TIMBER, PLYWOOD—PER M FT., B.M., CARLOAD LOTS F.O.B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face) — *All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)*									LONG LEAF Y. P Merchantable grade up to 20 ft.		PLYWOOD Rail freight increment (See note for base price)	
	1x6 s'n	1x8 s'n	2x4 s'n	2x6 s'n	2x8 s'n	2x10 s'n	3x12 Rgh	6x12 Rgh	12x12 Rgh	2x12 Rgh	12x12 Rgh	5/8"	3/4"
Atlanta	$75.00	$75.00	$65.00	$65.00	$65.00	$65.00	.....	.....	.....	$86.00	$86.00	$17.72	$21.57
	90.00	*90.00*	*88.50*	*88.50*	*87.50*	*87.50*	*$81.00*	*$80.50*	*$79.50*	.....	.....	.....	.....
Baltimore	74.00	75.00	71.00	70.00	70.00	77.00	90.00	.....	.....	185.00	180.00	18.45	21.995
	80.00	*82.00*	*80.00*	*74.00*	*79.00*	*80.00*	*95.00*	*87.00*	*85.00*	.....	.....	.....	.....
Birmingham	87.50	87.50	87.00	86.00	87.00	90.00	110.00	.....	.....	110.00	112.50	17.245	20.795
	93.50	*93.50*	*92.00*	*91.00*	*92.00*	*95.00*	*114.00*	*97.00*	*98.00*	.....	.....	.....	.....
Boston	70.00[a]	72.00[a]	66.50[a]	62.50[a]	70.50[a]	74.50[a]	70.25[a]	.....	.....	.....	.....	18.195	21.995
	64.75	*64.75*	*62.75*	*63.25*	*62.75*	*62.75*	*60.50*	*59.50*	*59.50*	*59.50*	.....	.....	.....
Chicago	‡ 100.00	100.00	95.00	95.00	95.00	98.00	98.00	.....	.....	125.00	125.00	14.555	17.555
	‡ *100.00*	*100.00*	*96.00*	*96.00*	*95.00*	*98.00*	*95.00*	*95.00*	*95.00*	.....	.....	.....	.....
Cincinnati	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17.245	20.795
Cleveland	[k] 120.00	120.00	120.00	120.00	120.00	125.00	130.00	.....	.....	140.00	150.00	17.615	21.265
	[k] *125.00*	*125.00*	*125.00*	*125.00*	*125.00*	*130.00*	*135.00*	*135.00*	*140.00*	.....	.....	.....	.....
Dallas	89.00	89.00	86.75	87.75	89.00	91.50	91.00	.....	.....	94.75	91.00	14.555	17.555
Denver	*91.50*	*91.50*	*87.50*	*87.50*	*86.50*	*86.50*	.....	.....	.....	.....	.....	10.285	12.435
Detroit	90.00	90.00	87.00	87.00	87.00	93.00	100.00	.....	.....	95.00	110.00	17.245	20.795
	98.00	*98.00*	*96.00*	*97.00*	*97.00*	*100.00*	*105.00*	*105.00*	*110.00*	.....	.....	.....	.....
Kansas City	[a] 86.00	86.00	84.00	82.75	83.25	86.00	105.00	.....	.....	105.00	110.00	12.605	15.205
	88.00	*88.00*	*87.50*	*87.50*	*86.50*	*87.00*	*85.00*	*105.00*	*105.00*	.....	.....	.....	.....
Los Angeles	[a] 87.00	87.00	88.00	89.00	87.00	87.00	100.00	100.00	89.00	.....	.....	9.81[gh]	11.86[gh]
Minneapolis	[b] 94.00[a]	92.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	13.765	16.615
	‡ *95.00*	*95.00*	*89.75*	*90.00*	*88.75*	*90.25*	*103.00*	*103.00*	*101.00*	.....	.....	.....	.....
Montreal	[e] 69.00	70.00	64.00	68.00	70.00	75.00	.20[i]	.....	.....	.20[i]	.20[i]	.....	.....
	97.00	*97.00*	*97.00*	*97.00*	*97.00*	*97.00*	*87.00*	*87.00*	*87.00*	.....	.....	.....	.....
New Orleans	42.00	42.00	39.00	38.50	34.00	42.00	46.00	.....	.....	54.50	69.00	14.555	17.555
	30.50	*30.50*	*30.00*	*30.00*	*29.00*	*29.00*	*28.50*	*29.50*	*29.50*	.....	.....	.....	.....
New York	‡ Range from $97.50 to $105.00						$120.00	.....	.....	.....	.....	18.195	21.995
	‡ *Range from $97.50 to $105*						*Range from $110 to $130*			.....	.....	.....	.....
Philadelphia	Range from $105 to $110							.....	.....	150.00	150.00	18.195	21.995
	Range from $110 to $120							*120.00*	*120.00*	.....	.....	.....	.....
Pittsburgh	59.40	61.80	71.35	63.60	69.45	73.10	84.85	.....	.....	130.60	141.00	17.88	21.63
	77.60	*76.70*	*74.70*	*73.90*	*73.80*	*74.35*	*91.35*	*96.85*	*96.85*	.....	.....	.....	.....
St. Louis	[j] 112.00	112.00	110.00	108.00	108.00	115.00	115.00	115.00	115.00	115.00	115.00	14.555	17.555
San Francisco	[d] *91.00*	*91.00*	*87.25*	*87.25*	*86.25*	*86.25*	*81.00*	*72.50*	*72.50*	.....	.....	7.33[g]	8.83[g]
Seattle	*80.50a*	*80.50a*	*80.50a*	*80.50a*	*80.50a*	*80.50a*	*45.00a*	*45.00a*	*45.00a*	.....	.....	.....	.....

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf. [2] Roofers' N. C. Pine. [3] Spruce. [4] Native. [5] Western Pine, No. 3 Common. [6] Spruce. [7] Norway Pine. ‡ Delivered. *a* Yard prices. *c* 5M ft. or less. *d* Sales through wholesale distribution yard (F.o.b. purchaser's truck or carrier, San Francisco paid). *e* Plus sales tax. *f* Up to 18 ft. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* FBM, scarce, no stable quotation, no ceiling. *j* Delivered in 500 ft. lots. *k* These are retail yard prices. Lumber is no longer available on the base previously quoted.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on 1", $95.15; on ½", $104.85; price includes oiling and sealing charges. For other centers add rail freight increment from table or proper size. For resin dipped treatment, add $10.50 per M.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Jan. 16, 1946 Single or Double Thickness		EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50 lb. cases delivered in 200 lb. lots*	
	A quality	B quality		
Atlanta	76%	76%	$0.18	
Baltimore	78%	79%	.18	
Birmingham	76%	76%	.135	
Boston	77%	78%	.18	
Chicago	725%	725%	.18	
Cincinnati	77-10%	77-10%	.18	
Cleveland	72-10-10%	77%[c]	.18	
Dallas	76%	76%	.1925	
Denver	71%	71%	.185	
Detroit	77%	77%	.18	
Kansas City	72.510%	72.510%	.18	
Los Angeles	86%[d]	88%[d]	.1875	
Minneapolis	73%	73%	.175	
Montreal	40-5%[ab]	47%[ac]	.1975	
New Orleans	70%	75%	.19	
New York	76%	77%	.25[f]	
Philadelphia	74%	75%	.18	
Pittsburgh	77%	77%	.1525	
St. Louis	77-10%	77-10%	.185	
San Francisco	66%	73%	.185	
Seattle	75%	75%	.1875	

Price of 60% Ammonia Gelatin is $0.01 per lb. higher than 40%

a Discount from list Sept. 1939: sales tax included, but 6% tax exemption not allowed for. *b* Single thickness. *c* Double thickness. *d* Discount from jobbers' list Sept. 15, 1928. *f* In borough of Kings, Queens and Richmond, and in Manhattan south of Canal St., add delivery charge of $6.00 per trip.

*Urban prices influenced by service charges or local storage and delivery regulations do not consistently reflect quantity prices in less congested areas.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.135	$0.16	$0.18
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.14 -.1475	.165 -.1775	.185 -.1975
Rocky Mtn. States	.14 -.1525	.165 -.1825	.185 -.2025
Pacific N. W. States	.1375-.15	.1675-.18	.1875-.20
Pacific S. W. States	.1350-.1425	.165 -.1725	.185 -.1925

PILES, TIES F.O.B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk.

Dimensions	Points	Length	By Rail — Pine*	Fir
12 in. at butt	6 in.	30 to 50 ft.	$0.34	....
12-in.—2 ft. from butt	6-in.	50 to 59-ft.	.35	....
12-in.—2 ft. from butt	6-in.	60 to 69-ft.	.36	....
12-in.—2 ft. from butt	6-in.	90 to 100-ft.	....	.57
13-in.—3-ft. from butt	5-in.	91 to 100-ft.	....	.59
14-in.—2-ft. from butt	6-in.	50 to 69-ft.	.41	.66
14-in.—2-ft. from butt	6-in.	70 to 79-ft.	.43	.60
14-in.—2-ft. from butt	5-in.	80 to 85-ft.	.54	....
14-in.—2-ft. from butt	5-in.	85 to 89-ft.	.57	....
14-in.—2-ft. from butt	5-in.	90 to 100-ft.	....	.65

* Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

Prices f.o.b. per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak	$1.50	.....	$2.00	.....
	Pine	2.00	$3.00a	2.50	$3.00a
New York	S. L. Sap Pine	1.65	2.85	2.00	3.30
	Mixed Oak	1.80	3.05	2.50	3.60
Birmingham	Hardwood	1.00	1.60a	.....	2.25a
Chicago	Red Oak	.....	2.65/2.75a	.....	3.55/3.70
Los Angeles	Douglas Fir	2.10	3.35a	3.00	4.80a
Philadelphia	Red Oak	.....	2.10ag	.....	3.25ag
St. Louis	White Oak	1.80	.....	2.50	.....
	Red Oak	....	2.40a	....	3.40a
	Sap Pine or Cypress	2.20	.....	.....	.....
San Francisco	Douglas Fir	1.25bt	.....	.....	3.00caf
Montreal	Birch or Maple	.....	1.65	1.04	.....

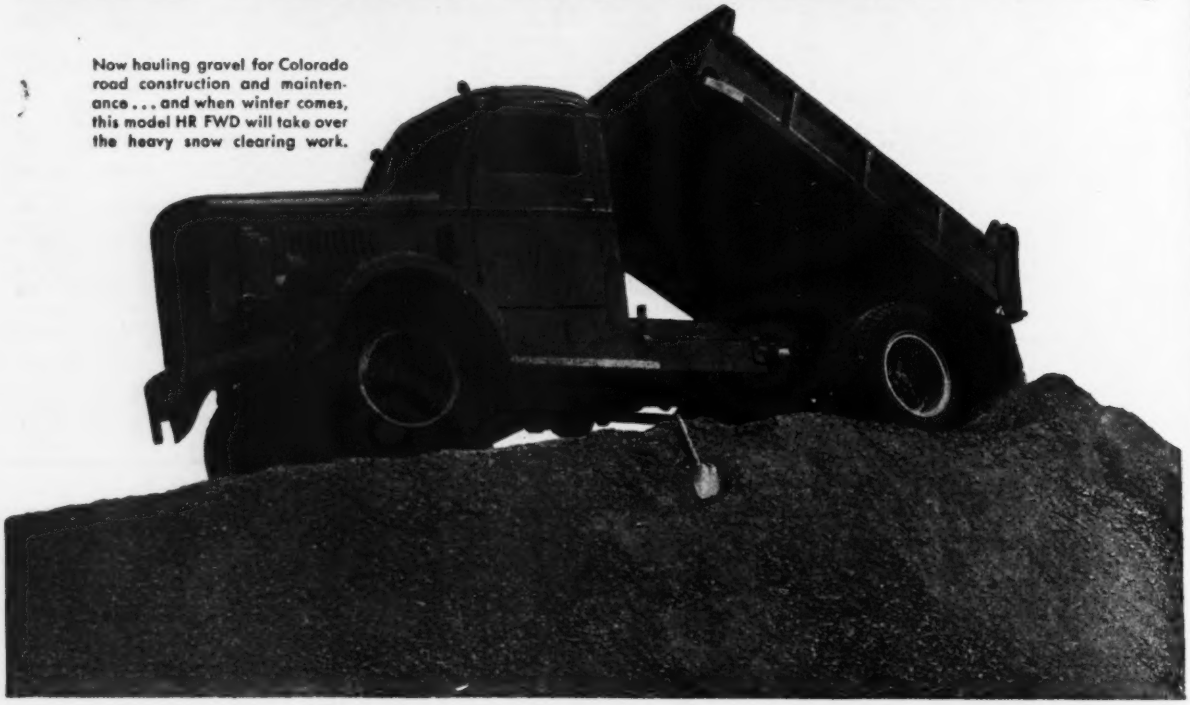
Tr.—Treated; Untr.—Untreated. *a* Creosoted. *b* 6"x8"x8'6". *c* Empty cell. *d* Zinc. *e* Green. *f* F.o.b. cars. † Out of market. *g* January 1943 price, none later available.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder in drums f.o.b. works, per 100-lb	$2.50- 3.10
Chlorine cylinders, liquid, per lb. delivered	.0525
Calcium chloride, 77-80%, flaked, 100-lb. paper bag, del'd, ton	21.50-38.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb	1.55
Soda ash, 58%, in paper bags, per 100 lb. dense	1.28
Sulphate of aluminum, commercial, in 100-lb. bags	1.15-1.20
Sulphate of copper, in bbl., per 100-lb	7.10

ON ALL HEAVY WORK ALL YEAR 'ROUND.. FWDs



Now hauling gravel for Colorado road construction and maintenance . . . and when winter comes, this model HR FWD will take over the heavy snow clearing work.

The same rugged plow-equipped FWDs that smash through heavy snow banks to keep highways open throughout the winter, are also unexcelled all the rest of the year for road construction and maintenance work. The "ONE truck for MANY jobs" takes on ALL kinds of heavy work, all year 'round, with dependability and dispatch, at low cost. FWDs are a sound investment for highway construction and all-year maintenance. They remain first choice in this heavy-duty highway field because the true FWD four-wheel-drive principle gives FWDs what it takes for consistent, outstanding performance. *See the nearest FWD Distributor, or write to . . .*

THE FOUR WHEEL DRIVE AUTO CO., Clintonville, Wisconsin

Canadian Factory: KITCHENER, ONTARIO

America's FWD **Foremost Heavy-Duty Truck**

One of seven new FWD Model HA trucks added to the Utah State Highway Commission's fleet, with 1100-gal. oil tank, for road surfacing.

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE PARTITION—SCORED Per M. lots of 2,000 pieces or over, 3x12x12 in	4x12x12 in	8x12x12 in	STRUCTURAL CLAY TILE—LOAD BEARING—SCORED Per M. lots of 2,000 pieces or over, 8x12x12 in	10x12x12 in	12x12x12 in	BRICK Per M. in quantity, Common backing	Straight hard	LIME Per ton, Hydrated finishing	In paper, Common hydrated	Carload lot, Pulverized, or lump
Atlanta	$112.50	$132.60	$234.60	$244.80	$273.40	$306.00	$24.00	$24.00	$19.00	$17.50	$17.50
Baltimore	90.00	95.00	175.00	200.00	260.00	300.00	23.75k	29.75k	20.00	15.00	2.50m
Birmingham	97.50	104.00	195.00c	231.00	.....	.....	19.00	21.50	20.11	17.05	18.05
Boston	105.00†	112.00†	210.10†	252.09†	.....	.....	20.00s	20.00s	21.00†	.....	16.00
Chicago	92.10	98.40	185.20	x	x	x	18.50	19.50	24.00	20.00	.....
Cincinnati	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cleveland	99.50	106.00	195.50	x	x	x	24.00	24.00	19.65	17.15	22.15
Dallas	.....	83.00	.....	.....	.....	.....	32.50	30.50	28.00	22.00	15.00
Denver	105.25	119.00	198.25	230.00	263.50	315.25	26.50	.....	34.80bb	28.00bb	34.00bb
Detroit	106.80	125.10	219.30	252.90	320.20	366.30	24.00f	26.00f	24.00	22.00	22.00
Kansas City	.....	.....	.....	.....	.....	.....	17.50	18.50	34.00	30.00	30.00
Los Angeles	r	r	r	r	r	r	16.50	18.50	21.80	18.80	22.80
Minneapolis	36.50cc	51.50cc	270.40cc	151.50vcc	.....	.....	18.50v	.....g	30.00bb	23.00bb	30.00bb
Montreal	92.50a	98.50a	196.25a	151.50a	.....	294.40a	22.10	31.80	12.50u	14.00u	8.00u
New Orleans	104.50	109.55	207.25	222.25	326.90	385.65	17.75	.....	18.30	12.08	14.10
New York	103.90	110.80	152.35	166.70hn	x	x	25.50	.....	28.60	22.80	.....
Philadelphia	112.10	119.60	224.20	269.10	321.20	405.10	24.75	27.75	22.00	18.00	17.00
Pittsburgh	98.50	105.80	181.85	217.30	265.85	303.10	24.00	26.00y	19.40cc	16.90cc	2.85m
St. Louis	.....	.....	.....	.....	.....	.....	26.00v	25.00s	24.00s	20.00s	.75v
San Francisco	116.00	130.50	174.00	130.50t	.....	.....	25.00	.....	22.10	22.10	2.21m
Seattle	129.25	141.50	x	141.50cc	.....	.....	23.00k	28.00k	27.95s	27.95s	3.28m

*F.o.b. a Smooth. b Carload lots delivered to job. c 6 x 12 x 12 in.-3 cell. f Includes $3.50 per M. for delivery. g No quotation. h F.o.b. Perth Amboy, N. J. i F.o.b. Warehouse only. k $1.00 discount. m Per bbl., 180 lb. n 7½ x 7½ x 12 Speed tile. o Per bbl., 200 lb. r Not used because of earthquake danger. s 2% discount for cash. t 5½ x 8 x 11½. u 8% sales tax included. v sand lime. w 5 x 8 x 12. x Not available. y Stacked. z Pebble lime, price per 80 lb. sack. bb LCL, delivered. cc Truck delivery.

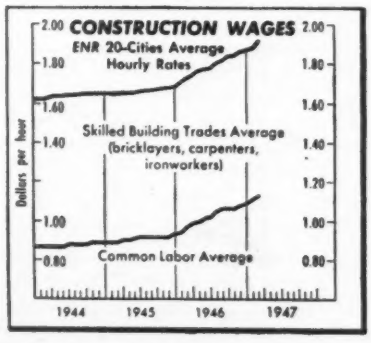
PAINT, ROOFING—F.O.B. CARLOAD LOTS

	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl. Dry a	WHITE LEAD Per 100 lb. in 100 lb. cases In oil w	READY-MIXED PAINT Per gal., drums Graphite b	Aluminum c	Ferric Oxide d	ROOFING SUPPLIES Carload lots f.o.b. factory Rolls, slate surfaced, 85-90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 360 lb. bbl. per ton
Atlanta	$16.75	$24.125	$1.75	$2.70	$1.65	$2.06	$2.06	$2.06	$1.00	$36.00
Baltimore	16.50	23.75	2.00	3.00	2.50	2.35	2.90	2.90	.40	29.00
Birmingham	16.75	24.125	3.36	4.70	....	2.50	2.50	2.50	.33	30.50
Boston	16.50	23.75	1.75	2.50	2.31	2.00‡h	3.30‡ut	3.30‡ut	.25‡	21.00‡
Chicago	16.50	23.75	....	....	....	1.75h‡	1.99h‡	1.99h‡	...	25.00‡
Cincinnati	16.50	23.75	....	....	....	....	.....	....	...	.....
Cleveland	16.50	23.75	2.25	2.25	2.25	2.10	2.15o	2.15o	.30y	30.00
Dallas	16.50	24.50	....	4.05	....	2.75h	2.90h	3.15h	.80	49.00
Denver	16.50	24.25	2.75	4.35	2.50	2.87	2.53h	2.53h	.35	29.00
Detroit	16.50	23.75	1.75	3.00	1.60	2.25	2.25	2.25	.50	23.00
Kansas City	16.50	23.875	3.30g	3.55g	3.16g	3.00	3.25	3.25	.67	.....
Los Angeles	16.75	24.25	2.80	4.00	3.50	2.60	1.90	....	.60	.....
Minneapolis	16.50	23.88	....	....	....	1.995i	2.0425hi	2.0425hi	.37	26.00
Montreal	.....	.....	2.90p	4.20p	3.62p	2.85	2.58l	2.07l	.68	1.85k
New York	16.50	23.75	3.45	....	3.45	1.995	2.0465o	2.0465o	.30	26.00
Philadelphia	16.50	23.75	75/2.00	2.40	1.70	2.54	2.94	2.94	.37	26.00
Pittsburgh	16.50	23.75	1.95	2.40	1.75	2.32	2.37h	2.37h	.37	28.00
St. Louis	16.50	23.75	2.28s	2.89s	1.96s	....	....	....	....	.....
San Francisco	16.75	24.00	1.80	2.75n	1.35	1.96x	....	....	.52	21.115
Seattle	16.75	24.25	1.95	3.09	....	2.22	2.23h	....	.36	31.93f

‡Delivered. Note: Red lead in oil 50c higher than white lead in oil. a Red lead prices change frequently due to pig lead price changes. b U. S. War Dept. Spec. 3-49A. c ASTM Spec. D266-31. d 80% minimum ferric oxide f Distributors' price to contractors. g 55 gal. can. h Per roll, 65 lb. i Minneapolis and vicinity. j Asphalt pitch. k per cwt. n May, 1941 price. o 60-lb. roll. p Plus 8% sales tax. s December, 1942 price. t Federal tax included. u 90-lb. roll. v Truck delivery. w Price to large paint contractors is $1.25 less. x Mineral surfaced. y 55-gallon container.

SKILLED AND COMMON WAGE RATES—PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor Building	Common Labor Heavy Const.
Atlanta	$2.00	$1.50	$1.75	$1.75	$2.00	$0.75	$0.85
Baltimore	2.25b	1.775	2.00	1.625/2.00	1.725	.95	.95
Birmingham	1.9375	1.50	1.75	1.50/1.75	1.875	.75	.85
Boston	1.725	1.75	1.85	1.65	1.667	1.25	1.25
Chicago	2.00	1.95	2.00	1.95	2.00	1.30	1.30
Cincinnati	.....	.....	.....	.....	.....	.....	.....
Cleveland	2.125	2.00	2.125	1.55/2.125	2.125	1.275	1.375
Dallas	2.00	1.625	1.75	1.75	1.875	.90	90/1.25
Denver	1.985	1.70	1.70b	1.70b	1.90	1.10	1.35
Detroit	2.00	1.825	2.00	1.85/2.00	2.00	1.275	1.275
Kansas City	2.00	1.75	1.875	1.875	2.00	1.175	.90
Los Angeles	2.00	1.75	2.00	1.75	2.05	1.25	1.25
Minneapolis	1.825	1.65	1.75	1.70	1.90	1.15	1.15
New Orleans	1.625	1.375	1.625	1.55	1.625	.70	.80
New York	2.50b	2.50b	2.50	2.50b	2.50b	1.25	1.25
Philadelphia	2.00/2.25	1.775	1.90/2.00	2.25	2.00/2.25	1.025	1.025
Pittsburgh	2.15	2.00	2.00	2.05	2.00	1.15	1.15
St. Louis	2.25	1.95	2.00	2.20	2.25	1.20	1.20
San Francisco	2.25	1.75	2.00	1.85	2.25	1.25	.125
Seattle	2.105	1.805	1.93	1.95	2.105	.1.405	1.30
Montreal*	1.17	1.06	1.11	1.00	1.17	.73	.73



b 7 hr. day. *Cost of living bonus now included in basic wage.

ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $1.919.

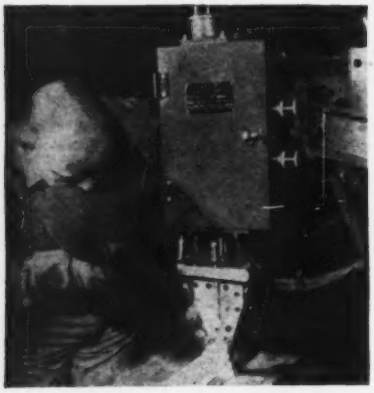
ENR Common Average: $1.123

New Aids to the Constructor

MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

Heavy Duty Power Take-offs—Large scale production will be begun in 1947 on eight standard models of Davey heavy duty power take-offs. The take-off uses, as its basic principle, an internal and external gear drive, operating as a strong and durable spline. Installation is made to the rear of the truck transmission case.

The eight power take-offs are available in 50, 75 and 100 hp. capacities.—*Davey Compressor Co., Kent, Ohio.*



Automatic Electrode—As in the manual shielded-arc electrode, the new Shield-O-Matic electrode combines all the materials necessary for producing a crucible-enclosed welding arc. A metallic grid construction that binds a heavy flux coating to the wire core provides extreme flexing and bending without loss of flux and continuous feed into the mechanically maintained arc from a reel. In that the grid extends to the periphery, welding current is conducted through the heavy coating of flux to the inner steel core.

The fin-ridged construction of the core provides conduction of unusually high welding currents; electrode and base metal melt at a fast rate and welds are exceptionally uniform. — *Hollup Corp., division of National Cylinder Gas Co., Chicago, Ill.*

Fire Extinguisher—Small, compact, with trigger-quick acting valve feature, a new "mighty midget" fire extinguisher is called the Alfco Speedex—with contents weighing only 3⅝ lb., but which expand upon release to 450 times their contained volume. It is only 3¾ in. in dia. with an overall length of 22 in. It is operated by quick acting squeeze-type valve which releases the carbon dioxide extinguishing agent by palm pressure.

Speedex carbon dioxide gas is non-poisonous, non-corrosive and odorless. It is a non-conductor of electricity, and will not freeze at any climatic temperature. It is heavier than air and will not support combustion.—*American-LaFrance-Foamite Corp., Elmira, N. Y.*

Scaffold Unit—A new quick action scaffold unit consists of only five lightweight, compact, easy-to-handle parts. Its welded, tubular-metal construction offers greater scaffold strength, rigidity, and safety, and the streamlined design provides light weight and a broad range of application possibilities not common with the use of ordinary trestle equipment.

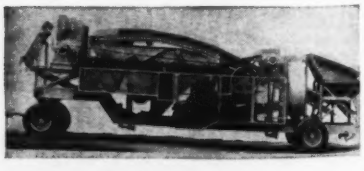
Four hand-set screws make possible any vertical or horizontal adjustment. Accessory pedestals in two heights permit flexibility in height.—*Bil-Jax Manufacturing Co., Swanton, Ohio.*

Drafting Pencil—A new aluminum drafting pencil, known as the Elastichuck pencil, has a collet in the neck of the chuck which grips the lead and cushions it against undue pressure, eliminating unnecessary lead-breakage. The rubber collet is the only contact between lead and pencil. The hardened steel chuck cannot be damaged when sharpening leads against a file or sandpaper pad and is knurled for those who grip a pencil close to its point. The barrel is also knurled and tapered. A roll-stop keeps pencil from rolling off inclined drawing boards.

This pencil, available in single or double end, uses all standard drawing leads; an indexed tip identifies the lead in the pencil.—*Elastichuck Sales Co., Box 220, Inglewood, Calif.*

Scoopmobile—The new Model "B" Scoopmobile incorporates several outstanding new improvements. It is a tricycle type materials handling machine. Complete bucket control is accomplished by means of two hand levers controlling an entirely new pick-up, hoisting and discharging mechanism. The operator can pick up a full load from a stock pile without "shock loading." Design of the bucket has been changed to eliminate spillage over rough terrain, and partial loads can be discharged as the bucket can be placed in any angle and closed at any time during discharge operation. Digging angle can now be controlled without lowering bucket to ground.

The standard Scoopmobile weighs approximately 5,300 lb. and overall length is only 14 ft. Turning radius is only 9 ft.—*Mixermobile Manufacturers, 6853 N.E. Halsey St., Portland 15, Ore.*



Portable Crushing and Screening Plant—A new, small, portable crushing and screening plant, the Pitmaster Straightline, has a primary crusher with a 10 x 16 in. roller bearing jaw; the secondary is a 16 x 16 in. roller bearing roll crusher. The 30 in. x 9 ft. 5 in. double-deck horizontal vibrating screen gives the plant exceptionally low travel-

WHEN TIME MEANS MONEY

IT PAYS TO BE A CLOCK-WATCHER!

If hours mean dollars on your job, get out your watch to do a little checking. How long does it take *your* crew to install wireways, conduit or pipe hangars? Are they punching or drilling holes in steel members to bolt on clips or hangars? Are they juggling around with expensive two-piece clamping gadgets? If they are, come over to this typical NELSON automatic stud welding job and see how much time you've been losing.

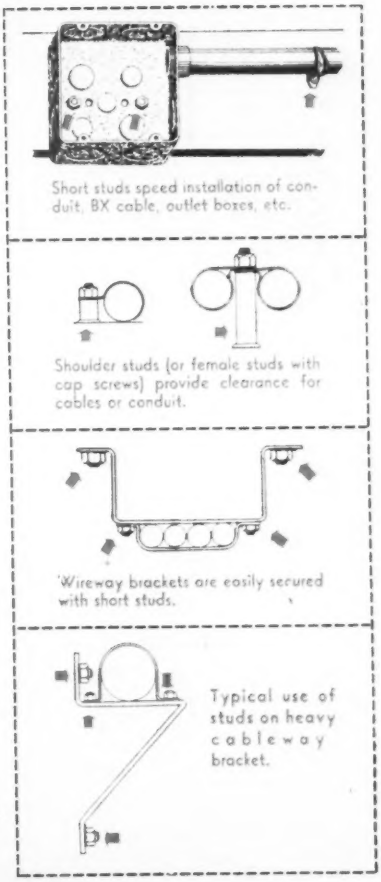
The man pictured up there is "shooting" NELSON studs at the rate of 150 per hour. He's doing it with the 5-lb. NELSON stud welding gun, powered by a standard 400-amp. d.c. welding generator. All he does is load the stud and protective porcelain ferrule (furnished with the studs) into the gun chuck, contact the beam with the stud tip, and pull the trigger. Weld cycle is entirely automatic, regulated by the NELSON timer control unit. Welds are uniform, and weld strength exceeds that of the stud.

Sketched at right are a few typical NELSON stud welding applications on wireway, conduit and piping installations. Scores of other NELSON construction applications—securing corrugated roofing and siding, insulation wire lath and other collateral materials—offer savings you can't afford to miss. Write or wire *now* for prompt, helpful information.

NELSON SALES CORPORATION
2715 TOLEDO AVE.
LORAIN, OHIO

Representing

Nelson Stud Welding Corporation Lorain, Ohio	Nelson Specialty Welding Equipment Corporation San Leandro, California



Short studs speed installation of conduit, BX cable, outlet boxes, etc.

Shoulder studs (or female studs with cap screws) provide clearance for cables or conduit.

Wireway brackets are easily secured with short studs.

Typical use of studs on heavy cableway bracket.

NELSON TRADEMARK

Worthington-Ransome Blue Brute Distributors

See ad on page 109 for list of equipment in each line

Worthington-Ransome Distributors

Ala., Birmingham, Construction Equipment Co.
Montgomery, Burford-Toothaker Tractor Co.
Alaska, Anchorage, Airport Mach. & Storage Co.
Ariz., Phoenix, Lee Redman Equipment Co.
Ark., Fort Smith, R. A. Young & Son
Little Rock, R. A. Young & Son
Cal., L. A. Golden State Equip. Co.
San Francisco, Coast Equip. Co.
Colo., Denver, Power Equipment Co.
Conn., New Haven, Wilhelm-Davies Co., Inc.
Fla., Miami, Allied Equip., Inc.
Orlando, Highway Equipment and Supply Co
Tampa, Epperson & Company
Ga., Atlanta, Tractor & Machinery Company
Ida., Boise, Olsen Manufacturing Co.
Ill., Chicago, Chicago Construction Equip. Co.
Ill., Chicago, Thomas Hoist Co.
Iowa, Cedar Rapids, McNall Mach. & Supply Corp.
Ill., Chicago, J. A. Roche
Ky., Harlan, Croushorn Equip. & Supply Co
Louisville, Williams Tractor Co.
Maine, Portland, Maine Truck-Tractor Co
Mass., Allston, Boston, Clark-Wilcox Co.
Mich., Muskegon, Lakeshore Machy. & Supply Co
Minn., Minneapolis, Phillippi-Murphy Equip. Co
Miss., Jackson, Jackson Road Equip. Co.
Mo., Clayton, The Howard Corporation
Mo., Kansas City, Machinery & Supplies Co., Inc.
St. Louis, W. H. Reaves
Montana, Billings, Interstate Truck & Equip. Co
Helena, Caird Eng. Works
Nevada, Elko, C. W. Paul Hardware
N. J., No. Bergen, American Air Comp. Corp.
N. M., Albuquerque, Bud Fisher Co.
Roswell, Smith Machy. Co.
N. Y., Albany, Milton-Hale Machinery Co
New York, Hodge & Hammond, Inc.
New York, Railroad Materials Corp.
Syracuse, Milton-Hale Mach. Co.
N. C., Raleigh, Smith Equip. Co.
N. D., Fargo, Smith Commercial Body Works, Inc.
Ohio, Cincinnati, Carroll-Edwards & Co.
Dayton, Carroll Edwards & Co.
Okla., Oklahoma City, Townsco Equip. Co
Oregon, Portland Andrews Machinery
Pa., Wilkes-Barre, Ensminger & Co.
Mechanicsburg, American Equip. Corp.
Philadelphia, Metalweld, Inc.
S. C., Columbia, Smith Equipment Co
Tenn., Knoxville, Dempster Bros., Inc.
Memphis, Independent Tractor Co.
Nashville, Dempster Bros., Inc.
Tex., Amarillo, T. W. Carpenter Equip. Co.
Dallas, Shaw Equip. Co.
Houston, Contractors Equip. Sales & Service Corp.
San Antonio, Patten Machy. Co.
Tyler, D. M. McClure Equip. Co.
Utah, Salt Lake City, J. K. Wheeler Mach. Co.
Vt., Barre, A. M. Flanders, Inc.
Wash., Spokane, Andrews Equip. Service
Va., Richmond, Highway Machy. and Supply Co.
W. Va., Charleston, Allied Equip. Co.
Wisc., Milwaukee, Drott Tractor Co., Inc.

Ransome Distributors

Ark., Fort Smith, Central Welding Equip. Co.
D. C., Washington, M. A., Doetsch Mach. Co.
La., New Orleans, Ole K. Olson Co.
Md., Baltimore, Stuart M. Christhilf & Co.
Mich., Detroit, T. G. Abrams
Mich., Detroit, Welding Equip. & Supply Co.
N. Y., Buffalo, Murray Equip. Co.
N. Y., Rochester, B-G Equip. Co.
Pa., Pittsburgh, Arrow Supply Company
O., Cleveland, H. B. Fuller Equip. Co.

Worthington Distributors

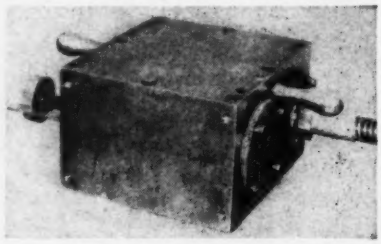
Ind., Indianapolis, Reid-Holcomb Company
La., New Orleans, Wm. F. Surgi Equip. Co.
Md., Baltimore, D. C. Elphinstone, Inc.
Mass., Cambridge, Field Mach. Company
Mich., Detroit, W. H. Anderson Co., Inc.
Flint, Gransden-Hall & Co.
N. Y., Buffalo, Dow & Co., Inc.
New York, Air Compressor Rental and Sales
O., Cleveland, Gibson-Stewart Co.
Toledo, The Kilcorse Mach. Co.
Pa., Allentown, H. N. Crowder, Jr., Inc.
Pittsburgh, Atlas Equip. Corp.
Texas, El Paso, Equip. Supply Co.
Washington, Seattle, Star Machinery Co.
Wyoming, Cheyenne, Wilson Equip. & Supply Co.

Blue Brute Dozers

Worthington Pump and Machinery Corp.
Worthington-Ransome Construction Equipment Division
Holyoke, Massachusetts

ing height.

The plant is offered with a choice of reciprocating feeder or swivel feed attachment to fit different feeding conditions. Other optional equipment includes chip attachment and bins with delivery conveyor extensions. Total weight of the Pitmaster is 31,000 lb. without power unit; transport length with feeder attached is 33 ft. and traveling height 11 ft. The plant is operated by a 50-60 hp. gasoline or diesel engine. It is a complete gravel plant and can be quickly converted into a modern quarry plant by putting a 15 x 36 in. or 15 x 24 in. portable primary ahead of it.—*Iowa Manufacturing Co., Cedar Rapids, Iowa.*



Mechanical Oscillator—The Sonntag LA-1 oscillator, a compact, portable machine for inducing vibrations in structures and assemblies. weighs only 61 lb. and is attached to the structure or machine. The centrifugal force produced by eccentrically supported weights, rotated so that all forces add in one direction and cancel each other in all other directions, provides vibration for the test. The force is steplessly adjustable either while running or stationary by turning the micrometer type knob. The maximum allowable force of the machine itself is 1,600 lb., but this is multiplied in resonance with the structure under test. The multiplication factor is determined by the damping of the structure. Factors as high as 200 have been encountered, making the machine capable of producing loads of 1,600 x 200, or 320,000 lb.

The oscillator has two types of drive, a flexible shaft that will permit the motor to be mounted away from the oscillator, or a V-belt drive for direct mounting. A standard accessory is a control cabinet and desk, mounted on casters, that provides space for reading instruments and controls as well as storage.—*Baldwin Locomotive Works, Philadelphia 42, Pa.*

Power Jacklift—Vertical handle operation and the electric brake are featured in Lewis-Shepard's new power jacklift, built in both platform and pallet models. It is electrically operated with complete electric button operation located in the handle head. Every operation of this truck can be performed with the handle vertical. Even in close quarters, the operator can maneuver easily and stop safely. In the vertical position or when lowered, the handle has a steering arc of 200 deg. Both models are driven by a replaceable electric master drive unit.—*Lewis Shepard Products Inc., 248 Walnut St. Watertown 72, Mass.*

Bench Grinder—A new 6 in. heavy duty bench grinder has modern streamlined housings of die-cast zinc to improve working clearances and decrease weight. Strong steel wheel guards and covers give extra protection and meet all safety requirements besides being wide enough to accommodate a standard 3-section wire wheel brush without any change in the guard. Fitting around the grinding wheel for improved support in tool sharpening are adjustable U-shaped tool rests. On the face of the grinder base a machined hole is provided for mounting attachments commonly used on bench grinders.—*Black & Decker Co., Towson 4, Md.*

Plastic Streetlight Globes—Streetlight globes of "Lucite" acrylic resin, a tough, transparent plastic, have recently been developed for use in city parks, alleys and secluded areas where vandalism causes high mortality of glass globes. The plastic has excellent light-diffusion properties and combines all the advantages of glass for the purpose with additional quality of impact-resistance.

The globes are made of four sheet sections of patterned Du Pont "Lucite" which are slipped into slots of a metal holder to form the familiar vase-shaped streetlight enclosure.—*E. I. duPont de Nemours & Co., Arlington, N. J.*

Safety Belt—A new type Strauss lineman's safety belt, incorporating all of the superior qualities of both web and leather construction, is made of Diamond Stripe web strap 1¾-in. wide by ⅛ in. thick, with a tensile strength of 4,500 lb. Inside this strap is fitted a 4-in. wide web body pad which in turn is lined with soft, pliable leather. Rivet burrs are positioned between the web and leather layers. Tool loops are of oak tanned harness leather 1¼ in. wide, attached to belt by hand-set copper rivets. Attachments include snap, leather plier pocket and tape holder. Weight of the belt, No. 625 PP, is only 3 lb.—*Portable Products Corp., 399 Blvd. of the Allies, Pittsburgh, Pa.*

HI-UP... IN NAME, REPUTATION AND QUALITY

Flexibility, engineered into all Ransome Blue Brute Truck Mixers, reaches its peak in the new Hi-Up. This flexibility eliminates all strains resulting from misalignment while charging, discharging, or operating over uneven ground. The truck mixer is designed so that when discharging is completed, all moving parts return to their normal positions.

The transmission shows a marked advance over usual design. Enclosed water pump clutch requires no adjustment and at no time is there any need for manual lubrication. A separate engine clutch, two speeds forward and reverse, and multiple disc clutches assure easier starting, a wider performance range and smoother operation.

Other new design details: Unbreakable, anti-freeze gauge glasses, in full view of the operator . . . Quick-charging, unobstructed hopper, with improved sealing door, prevents jamming . . . Positively leak-proof poppet valves with renewable discs — found only in Ransome Truck Mixers . . . Exclusive mixing drum design, with new type spiral blades, for quick charging and fast, clean discharging.

These are but a few of the reasons why the Blue Brute Hi-Up is setting a new high in truck mixer performance — and offering time-saving, trouble-free production of better concrete at lower cost.

Get the whole story from your near-by Worthington-Ransome dealer, or write for Bulletin No. 221.

PR6-7

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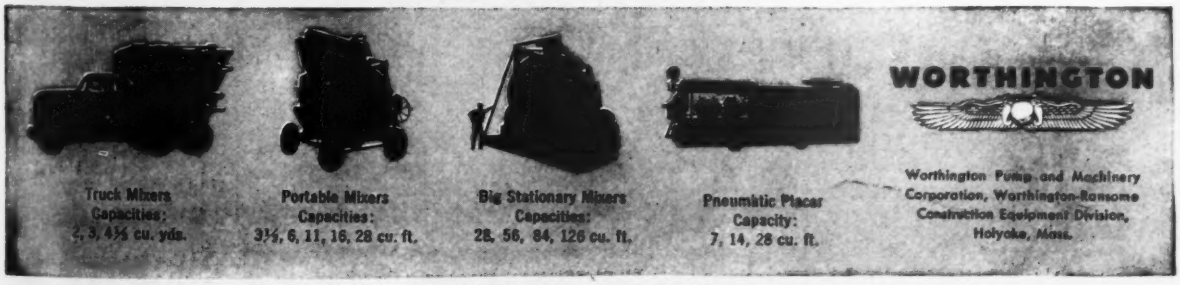

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Men and Jobs

James T. Voshell, division engineer, Public Roads Administration, Federal Works Agency, at Chicago, has retired after 40 years. He had been with Public Roads longer than any other employee. Shortly after receiving his B.S. degree in civil engineering at Purdue University in 1906, Mr. Voshell was appointed junior assistant highway engineer in the old Office of Public Roads. In 1913 he became senior highway engineer. Three years later he directed federal-aid highway work in Illinois, Indiana, Kentucky and Michigan. He continued there with a change in title until his retirement.

Mr. Voshell's career as a Public Roads employe paralleled the development of the federal-aid highway system. He had an active role in the various federal-aid programs which eventually transformed narrow, unsurfaced rural roads into broad, well-paved highways.

When field offices of the Public Roads Administration were reorganized in 1945 and district offices became divisional offices, with a subsidiary district office in each state, Mr. Voshell was appointed division engineer. He continued to direct the federal-aid highway program in the states that had been under his supervision as district engineer.

Mr. Voshell's duties as division engineer have been taken over by **R. H. Harrison,** highway engineer in the Chicago office, who has been appointed acting division engineer.

Arthur Dixon, who has been with the Public Works Department of the Province of British Columbia for the last 30 years, has resigned as deputy minister. During this period he directed the building of thousands of miles of highway and many public buildings in the province.

Lt. Col. George N. Kibler, acting U. S. district engineer at Cincinnati, Ohio, has become executive officer at Louisville, Ky., on the staff of Col. B. B. Talley, district engineer.

George W. Reed has been appointed city engineer of Yuba City, Calif., to succeed the late Leon Bunce. Reed previously was with the California division of water resources and in private

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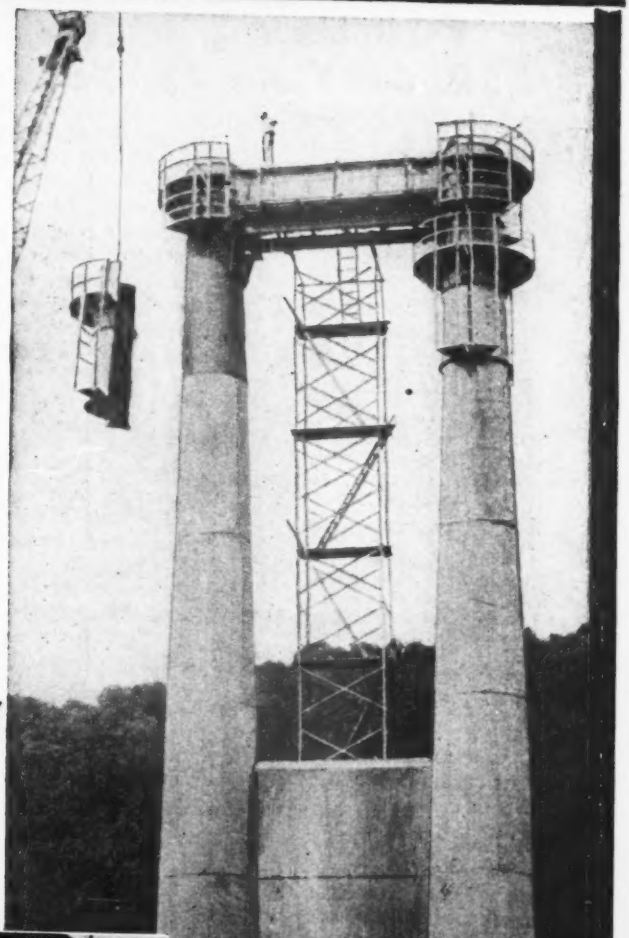

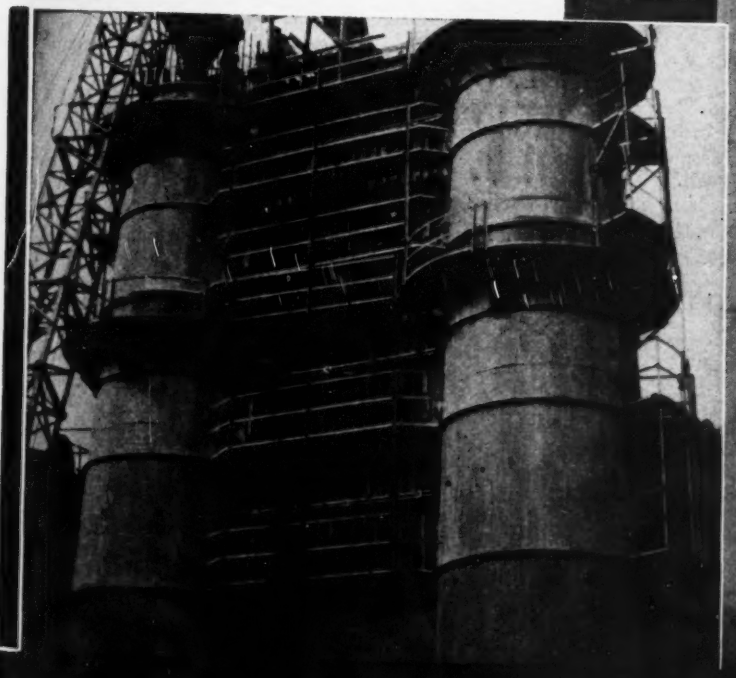

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William Kelly, of Buffalo, N. Y., an authority on public utilities and electric power, will become chief of the public utility section of the industrial branch of the Office of Military Givernment in Berlin. Mr. Kelly, who is chairman of the Buffalo-Niagara Electric Corp. and former president of the Buffalo, Niagara & Eastern Power Corp., will leave for Germany at once upon his retirement under the company's retirement plan. He was chief engineer of the 42nd Division in France during the first World War, and chief engineer of the Federal Power Commission for five years before becoming an officer of the power utilities in 1926.

M. A. Ankele, Danville, Ill., recently hydraulic engineer with the Chicago and Eastern Illinois Railway Co., has been named consulting engineer for the Inter-State Water Co., Danville. A graduate of the Sibley School of Engineering, Cornell University, with special work in Ohio State University, Mr. Ankele has had experience in power plant work, and steam boiler and hydraulic engineering with the Erie and the Rock Island railroads.

J. B. Dannenbaum, city engineer of Bellaire, Tex., has been appointed engineer for that city's proposed million-dollar sewer and water improvement program.

Edward de Harne has been named chief engineer of the Honolulu Rapid Transit Co. This is a promotion from superintendent of ways and structures, a post he had held since 1931. He was born in Kohala, Hawaii, in 1904, and was graduated from St. Louis College, Hawaii, in 1924. He advanced in the engineering profession while employed as a timekeeper for the transit company by studying civil engineering correspondence courses from the mainland.

O. J. Porter, formerly chief engineer, materials and research department, California Division of Highways, has formed his own consulting firm in Sacramento. Associated with Porter are W. H. Jervis, H. R. Cedergren, and B. D. McCreary. Mr. Porter is identified with the California bearing ratio method of designing flexible pavement, soil compactions, and the development of vertical sand drain for controlling consolidation of unstable foundations.

Mr. Jervis was formerly head of the soils embankment section of the U. S. Waterways Experiment Station at Vicksburg, Miss., and head of soils in the U. S. Engineers' Vicksburg district, specializing in dam and levee design. Mr. Cedergren was formerly head of the soils department, U. S. Engineers, Portland, Ore., district, and specializes in airports, seepage, and the theoretical phases of earth dam construction. Mr. McCreary is a graduate geologist and formerly with the California Highway Division.

The associates have had extensive experience in testing soils, aggregate, concrete and foundations for heavy buildings and bridges, and in designing earth dams, levees, embankments and pavements.

Roger V. Gillam, structural engineer, has joined the Portland, Ore., engineering firm of Sidney P. Lathrop & Associates. He formerly was with Timber Structures, Inc.

Lucius T. Hill, Brookline, Mass., has been appointed director of housing for the John Hancock Mutual Life Insurance Co. Mr. Hill will supervise the department of housing. Construction of the first of these projects is under way in Brookline and West Roxbury and entails an expenditure of $12,000,000. Mr. Hill will direct investigation and the development of sites for other John Hancock housing projects elsewhere.

Arthur D. Kidder, leading cadastral engineer in the Department of the Interior, whose scientific land measurements have been accepted as accurate in many court battles involving millions of dollars worth of property in the United States, has retired from the government service. He is remaining temporarily in Washington doing consultation work.

One of the foremost scientists in the government's ranks, Mr. Kidder began his public career 45 years ago when he joined the technical force of the then General Land Office, now part of the Bureau of Land Management, in the Department of the Interior in 1901. Through the nearly half century of service which followed he became a universally recognized expert in the technical aspects of cadastral engineering, involved in the measurement of the nation's public lands.

New assistant district engineers for the New York State Department of Public Works district offices in Albany and Utica have been announced as follows: **Edward Stickney,** formerly of the Albany district office, was reassigned there to succeed Peter J. Lamb, of Troy, who has retired. At the same time **Col. John P. Larsen,** associate civil engineer at the Rochester district office, was given a provisional appointment as assistant district engineer at Utica to succeed Mr. Stickney. Until transferred to Utica on July 1, 1946, Mr. Stickney was assistant district engineer in Albany, the post to which he now returns.

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FINE SAND! One of Michigan's leading contractors used a LaPlant-Choate C-108 with an old RD-7 tractor and pusher to move this fine dune sand in building a recreation area along Lake Michigan. Scraper (equipped with oversize tires for extra flotation) got heaping loads in 15 to 20 seconds, traveling only 40 feet—a record few outfits could match in such hard loading material.

BIG ROCKS! Plenty tough going here — with rocks half as big as a desk plus bumpy terrain and close quarters. Yet F. G. Cheney's C-114 scraper did a remarkable job of "horsing in" the heavy clay overburden—rocks and all—on this stripping job for Lincoln Brick Co. Ripper used for breaking up rock overburden appears in the background.

STICKY GUMBO! LaPlant-Choate's high lifting front apron and exclusive method of positive forced ejection paid real dividends to Benbow Construction Co. on this pond building job in Kansas. As Supt. Dick Fields put it, "I've used them all and the LaPlant-Choate scraper has 'em all beat in every way. It moves more dirt at less cost than any scraper I've ever seen."

SANDY LOAM! In leveling this site for a new housing area, Contractor John Fleming loaded and spread a lot of yardage in a hurry, using a LaPlant-Choate C-108 scraper behind an International TD-18. Material consisted of wet sandy loam soil, mixed with tree roots and chunks of concrete from old foundations but the C-108 handled it with ease without the aid of a pusher.

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MEANS A LOT TO CITIES LIKE SIOUX FALLS, S. D.

Sioux Falls, S. D., is a typical American City. Like many other smaller towns, it is growing into a much more important distribution and manufacturing point. Water for further growth was needed in large—but economical quantities. The choice was a Layne Well Water System that is now producing a million gallons daily.

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Layne Vertical Turbine pumps are available in sizes to produce from 40 to 16,000 gallons of water per minute. High efficiency saves hundreds of dollars on power cost per year.

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LAYNE

WELL WATER SYSTEMS
VERTICAL TURBINE PUMPS

Elections and Activities

Col. Ike Ashburn of Houston has taken office as executive vice-president and general manager of the Texas Good Roads Association. He succeeds Charles E. Simons, who became executive vice-president for the Texas Mid-continent Oil and Gas Association in Dallas. Ashburn formerly managed the roads organization's headquarters at Austin, but more recently had been doing industrial relations work in Houston. He is a veteran of World War I.

At a recent meeting of the Intermountain Section, ASCE, held in Salt Lake City, Ralf R. Woolley, hydraulic engineer, U. S. Geological Survey, was elected president for 1947. Erwin E. Mosher and Douglas K. Jones were named first and second vice-president, respectively, and C. E. Painter was re-elected secretary-treasurer.

Bob Dethlefs, president of Dethlefs-Hannon Construction of Anniston, Ala., has been elected president of the Alabama Branch of Associated General Contractors of America. Other officers are Jake Moose, Birmingham, first vice-president; T. C. Brasfield, Birmingham, second vice-president; J. E. Woolley, Birmingham, treasurer; and J. B. Rawls, Birmingham, executive secretary.

At the annual meeting of the Halifax, N. S., branch of the Engineering Institute of Canada, E. C. O'Leary, of the McDonald Construction Co., Halifax, was named chairman; J. D. Kline, Halifax, became secretary-treasurer. On the new executive committee are: D. S. Wickwire, Yarmouth; A. A. Ferguson, Pictou; M. L. Baker, of Nova Scotia Technical College, Halifax; C. A. McNearney, of the Nova Scotia highways department, Halifax; A. D. Foulis, Halifax.

Gov. Coke Stevenson of Texas has announced the appointments of three new directors for the Lower Colorado River Authority to serve terms of six years each. They are E. A. Arnim of Flatonia; A. B. Spires of Austin; and Charles E. Crist of Blanco. They succeed B. A. Elzner of Bastrop County; S. Raymond Brooks and John Connally of Austin.

The Susquehanna Chapter of the Pennsylvania Society of Professional Engineers has been organized at Williamsport, Pa. Twenty-seven Professional Engineers became charter members of the thirteenth chapter of the State organization. S. R. Collins, Lewisburg, was elected president; R. F. Boyer, secretary; Robert McCullough, treasurer, and Burton X. Lentz, Watsontown, will serve as state director from the new chapter. The new group covers nine counties in the north-central section of Pennsylvania.

Harry W. Morrison, president of Morrison-Knudsen Construction Co., Inc., Boise, Ida., was re-elected president of the Southwestern Idaho Water Conservation Project, Inc., Ida., recently. Other officers, also re-elected are J. L. Driscoll and E. W. Rising vice-president; William E. Welsh, secretary, and W. W. Howell, treasurer.

A Milwaukee County chapter of the Wisconsin Society of Professional Engineers has been organized. Herbert Moore, consulting engineer, was elected president; Richard R. Ransom, designing engineer, vice-president, and Robert H. Hopwood, an engineer with Charles S. Whitney, consulting engineer, secretary-treasurer. Directors elected were F. T. Agthe, an Allis-Chalmers Manufacturing Co. processing engineer; Arthur Simon, an engineering and patent consultant, and Ray T. Behrens, Wauwatosa, of the county regional planning department.

T. L. Sears of Clear Lake, Iowa, has been elected president of the Associated General Contractors of Iowa. Sears, formerly a vice-president, succeeds R. W. Welden of Iowa Falls. Rudolph H. Weitz, Des Moines, and H. L. Hoak, Des Moines, were elected vice-presidents. George C. Koss, Des Moines, was re-elected treasurer, and O. W. Crowley, Des Moines, executive secretary for another term. Three divisions named these representatives to the board of directors—Ray VanBuskirk, Hawarden, grading division; Don Kaser, West Des Moines, paving and surfacing division; and A. F. Mathis, West Des Moines, re-elected electrical and water works division.

New officers of the Nashville, Tenn., Contractors' Association are as follows: C. Boman Williams, president; Phil Harding and Fred Rhea, vice-presidents; and L. C. Hamsberger, treasurer. R. L. Farrar is secretary-manager.

George T. McDonald is president of the Southeastern Association of Highway Officials. F. Elgin Bayliss is vice-president and M. E. Cox, secretary-treasurer.

New Engineering Books

(*Continued from page 96*)

STRUCTURAL PRECAST REINFORCED CONCRETE—By Kurt Billig. 91 pp. Cement and Concrete Association, 52 Grosvenor Gardens, London, S. W. 1., England. Price 10s. 6d.

GEOMETRY OF ENGINEERING DRAWING—Third Edition—By G. J. Hood. 362 pp. McGraw-Hill Book Co., New York and London. $2.75.

Reports and Pamphlets

UNIONIZATION OF PROFESSIONAL ENGINEERS AND CHEMISTS—By H. R. Northrup. Industrial Relations Monograph No. 12, Industrial Relations Counselors, Inc., Rockefeller Center, New York. $1.50.

INDUSTRIAL PEACE AND THE WAGNER ACT—By T. R. Iserman. McGraw-Hill Book Co., Inc., New York and London. $1.50.

A PROPOSED SYSTEM OF HIGHWAY FINANCING FOR THE STATE OF CALIFORNIA—By B. H. Lindman. Joint Fact-Finding Committee on Highways, Streets and Bridges, California Legislature, Sacramento, Calif.

THE LASALLE AND CANFIELD HOTEL FIRES. THE WINECOFF HOTEL DISASTER—By James F. McElroy. National Fire Protection Assoc., 60 Batterymarch St., Boston 10, Mass. 35c. each.

NINETEENTH ANNUAL HIGHWAY CONFERENCE OF THE UNIVERSITY OF COLORADO—Engineering Experiment Station, University of Colorado, Boulder, Colo.

PROCEEDINGS OF THE THIRD NEW ENGLAND TRAFFIC ENGINEERING CONFERENCE—National Conservation Bureau, 60 John St., New York 7, N. Y.

1946 PUBLIC WORKS CONGRESS REPORTS—Papers and Discussions at the 52nd Annual Meeting. American Public Works Association, Chicago, Ill. $2.

HOUSING AND PEOPLE—Memphis Housing Authority, 264 No. Lauderdale St., Memphis, Tenn.

HOUSING PRACTICES—War and Prewar—Bulletin No. 5. National Housing Agency, Superintendent of Documents, Washington 25, D. C. 15c.

VAPOR RESISTANT COATINGS FOR STRUCTURAL INSULATING BOARD—Bulletin No. 25. University of Minnesota, Engineering Experiment Station, Minneapolis, Minn.

SOIL SURVEY PROCEDURE AND ITS APPLICATION IN ROAD CONSTRUCTION—Bulletin No. 4: and RECOMMENDATIONS FOR OPEN-TEXTURED ASPHALT CARPETS—Road Research Bulletin No. 5. Department of Scientific and Industrial Research, Park House, 24 Rutland Gate, London, S. W. 7, England. Price 9d. and 3d., respectively.

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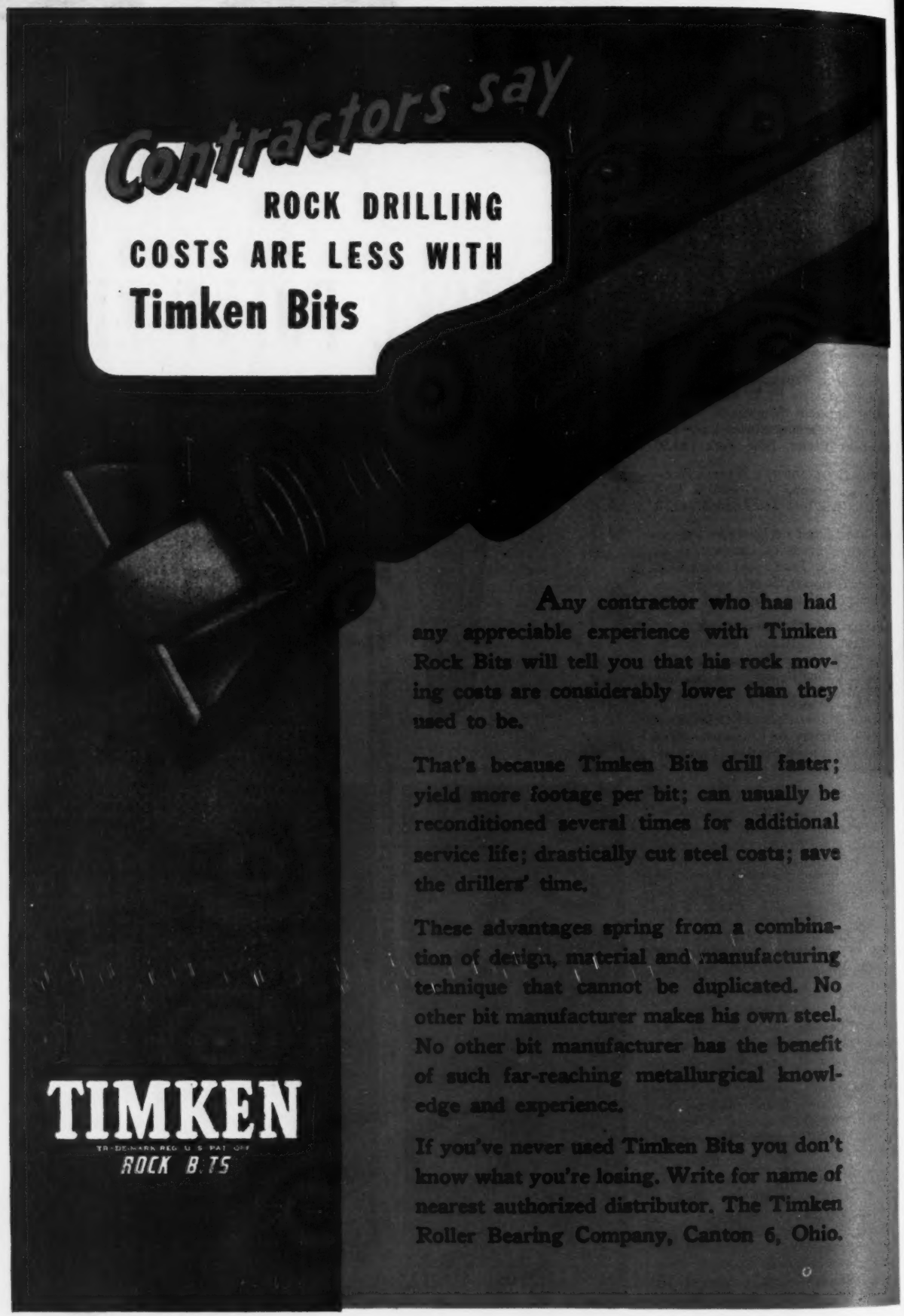

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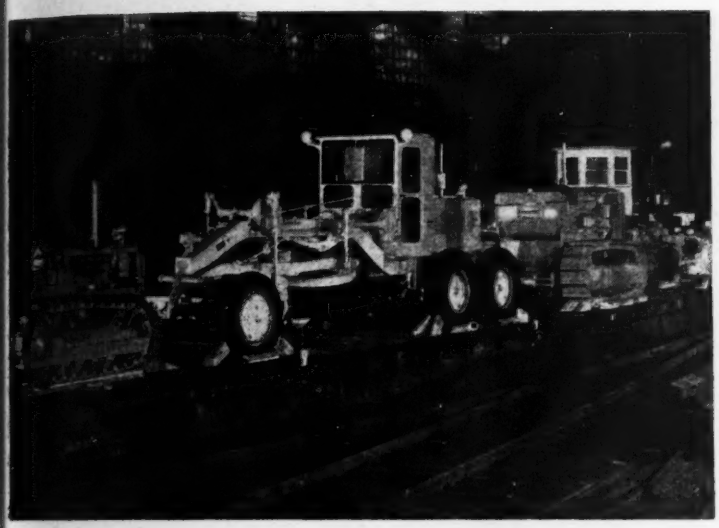

EVERY now and then a manufacturer succeeds in making a product so outstanding that public demand for it overwhelms production facilities. In his zeal for winning friends he finds himself making enemies — people eager to buy who cannot be assured immediate or even early delivery.

Thus, the earnestness the manufacturer has given to years of research and development — of product improvement and still better product performance—of efficient manufacture and unusual customer service . . . seems to come back to haunt him.

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In becoming the world's leading manufacturer of Diesel engines, track-type tractors and motor graders, "Caterpillar" found many buyers forming a waiting line during the years when all products went into war use. To that waiting line were added many more whose favor was won by the illustrious war performance of these machines.

Thus, despite the fact that "Caterpillar" production is at a high point, demand is still outrunning supply. To catch up—and also to provide an extra margin of facilities for future needs — production is being increased as rapidly as possible by an expansion program that is adding *50 per cent more plant.*

"Caterpillar" is deeply conscious of the problems of the many users who prefer and patiently wait for "Caterpillar" products. "Caterpillar" thanks every customer for such patience in awaiting his turn on deliveries. You can be sure that "Caterpillar" effort is the human utmost. It is live, resourceful — determined that, even in the face of material shortages and disturbed economic conditions, there shall be no unnecessary delays.

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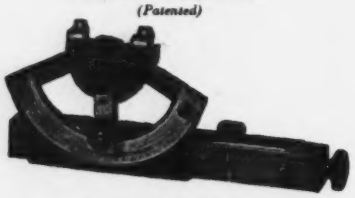

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Manufacturers' Activities

HARVEY T. GRACELY has been elected president of the Marion Power Shovel Co., Marion, Ohio, after serving the company in various capacities for many years.

R. G. LETOURNEAU, INC., Peoria, Ill., recently announced the final step in their program to create an international distribution organization. The corporation status of the export organization has been elevated to that of a full division, under the managership of Paul E. Fulford, located in New York, N. Y. Where the export department was formerly responsible solely for sales, the newly created export division will conduct all export functions including sales, service, credit, collections, merchandising, parts, installations, market research, field engineering, forwarding, etc.

LE ROI CO., Milwaukee, Wis., announces the appointment of E. Carl Price, Newburgh, N. Y., as their exclusive distributor for the New York counties of Orange, Rockland, Sullivan and Ulster. Mr. Price has been in business in Newburgh for the past thirteen years and will represent Le Roi's entire line of products.

C. HUIZING has been named New England representative for the Watson-Stillman Co., Roselle, N. J., dealers in forged steel fittings, valves, wire rope shears, hand pumps, jacks, etc. He was formerly in their sales department as sales engineer and has been with the company five years.

To take care of the growing demand for concrete equipment, WHITEMAN MANUFACTURING CO. has doubled the floor space of its building at 3249 Casitas Ave., Los Angeles, Calif. The chief products of this factory are Whiteman radding machines and floating-finishing machines.

Leasing by the INTERNATIONAL HARVESTER CO. of a tract of 1,920 acres near Phoenix, Ariz., as a site for experimental testing activities of industrial power equipment, has been announced. The land, formerly used by General Motors as a tank testing site, is located approximately 23 miles from Phoenix; it has been leased for a period of five years. The area will be used as a testing ground for International Harvester's line of industrial power equipment which includes heavy crawler tractors, power units, etc. Several makes of allied industrial equipment, used in conjunction with Harvester's line, will also be tested.

MARION DAVIS CALDWELL has been appointed assistant manager of the contractor's section, explosives sales department, of Atlas Powder Co., Wilmington, Del. He will make his headquarters at 3615 Olive St., St. Louis, Mo., and his activities will cover the entire Middle West.

O. W. (BILL) IRWIN has become president of The Rail Steel Bar Association with headquarters in Chicago. For the past eleven years Mr. Irwin was manager of sales of the concrete bar division of The Carnegie-Illinois Steel Corp.

LINK-BELT CO., Pacific division, Seattle, Wash., manufacturers of conveying and power transmission machinery, announce that they have completed and are now occupying their newly built plant at the corner of Sixth Ave. South & Hinds St. in Seattle. This modern new plant contains a machine shop, larger warehouse facilities, and office building. Fred A. Koepf, district manager, and Harvey V. Eastling, manager of engineering sales, direct the activities of the company in this Pacific Northwest area.

Acquisition by the M-R-S MANUFACTURING CO. of a new and larger site for the manufacture of Mississippi wagons was announced when title to a part of the Mississippi Ordnance Plant at Flora, Miss. was formally transferred to the company by the Reconstruction Finance Corp. The deeded property consists of 406.13 acres of land and eight buildings with a total of 79,000 sq.ft. of floor space, including a modern plant structure of 52,400 sq.ft. and an office building of 12,500 sq.ft. It is situated 23 miles north of Jackson.

KOEHRING CO., Milwaukee, Wis. is holding the second of a series of training courses designed to supply Koehring distributor salesmen with complete up-to-date sales information on Koehring products. Arthur E. Loder, veteran Koehring salesman and Washington representative during the war years, heads a staff of 25 lecturers. Lectures cover excavators, pavers, Dumptors, construction mixers, mud-jacks, longitudinal finishers, Kwik-Mix Dandie concrete, bituminous and plaster-mortar mixers.